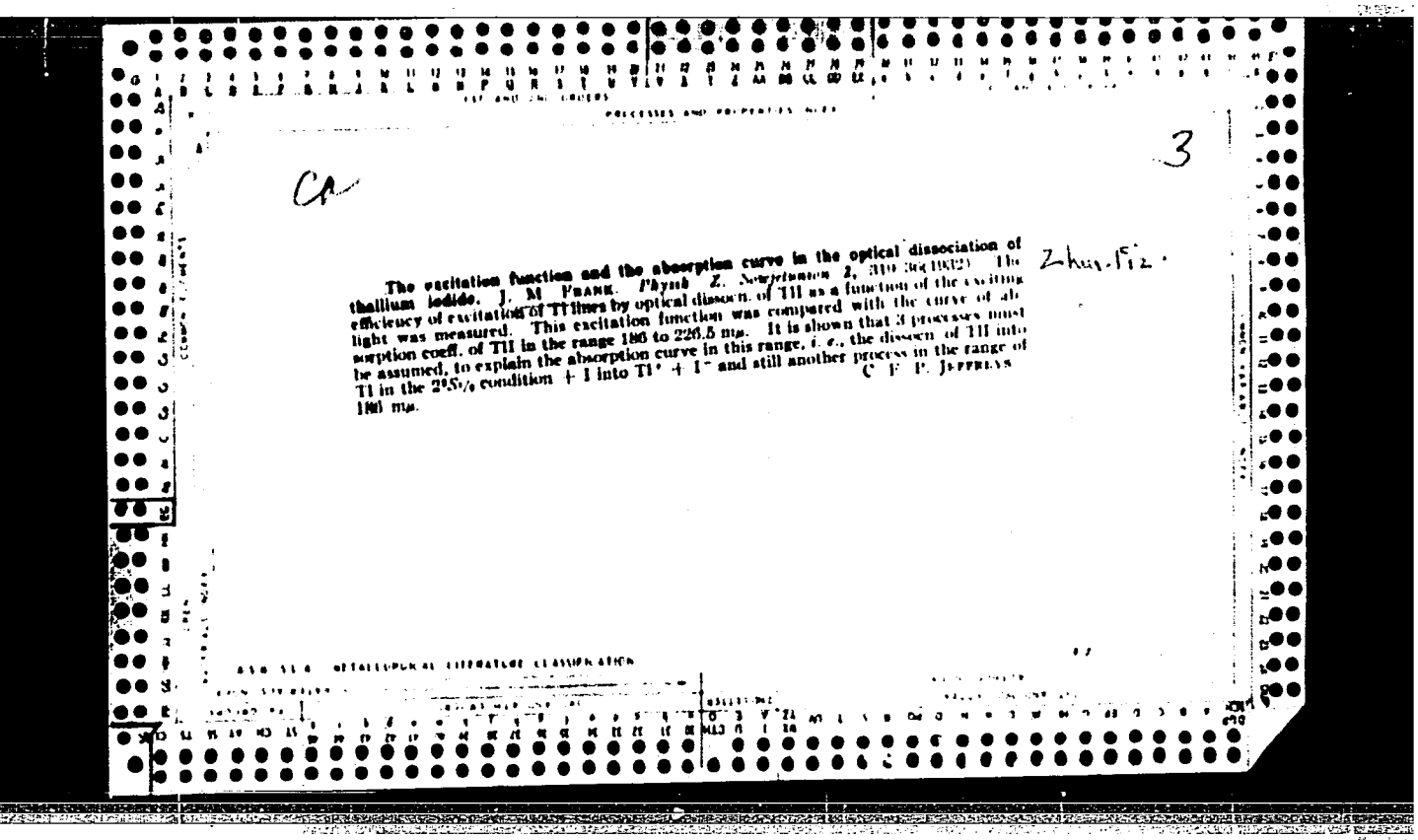


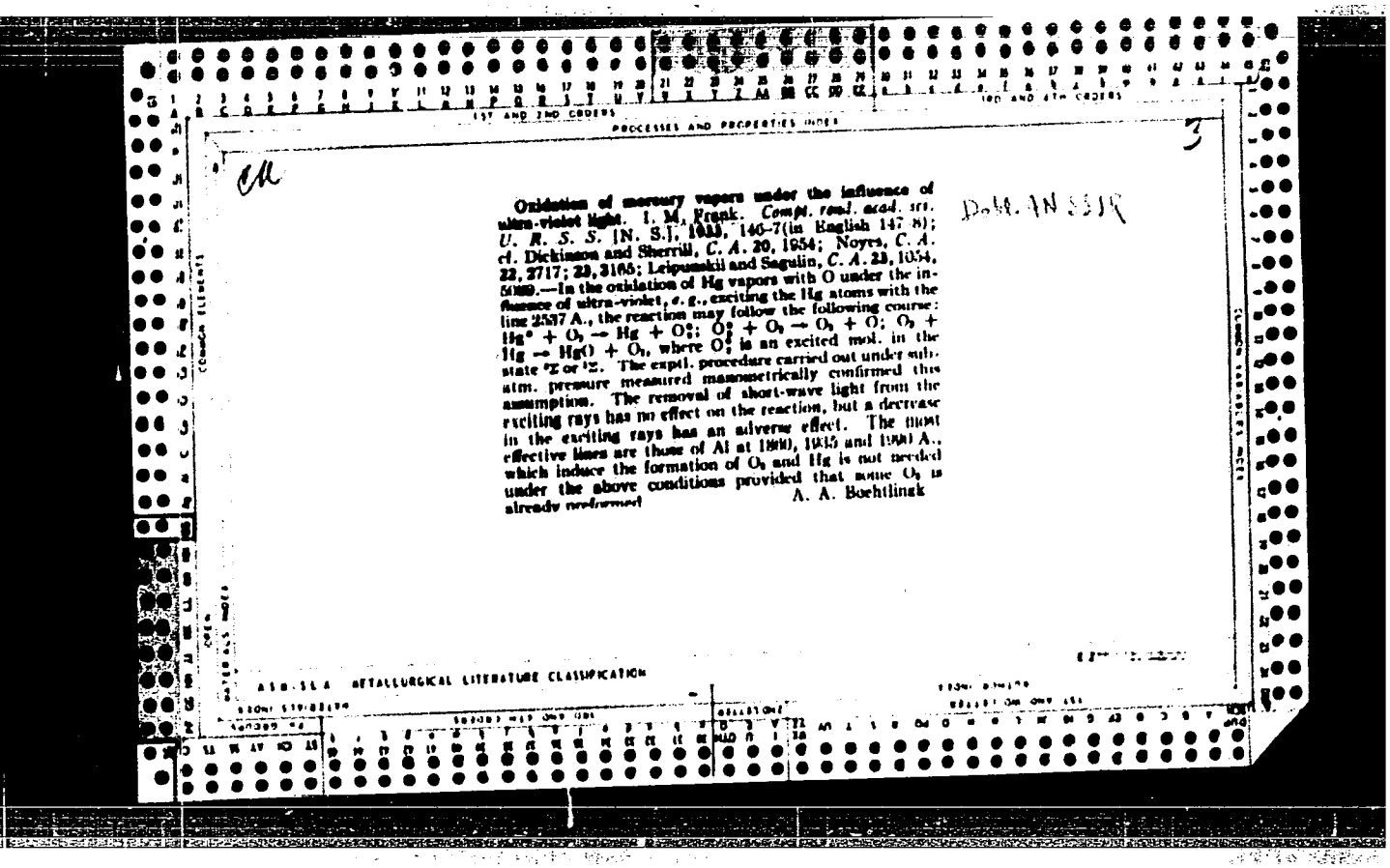
CA

3

Zhur. Fiz.

The excitation function and the absorption curve in the optical dissociation of thallium iodide. J. M. Frank. *Physik. Z. Sowjetunion* 2, 310-30(1932). The efficiency of excitation of Tl lines by optical dissocn. of TlI as a function of the exciting light was measured. This excitation function was compared with the curve of absorption coeff. of TlI in the range 186 to 226.5 mμ. It is shown that 3 processes must be assumed, to explain the absorption curve in this range, i. e., the dissocn of TlI into Tl in the 2S$_{1/2}$ condition + I into $Tl^+ + I^-$ and still another process in the range of 186 mμ.

C. F. P. Jeffreys

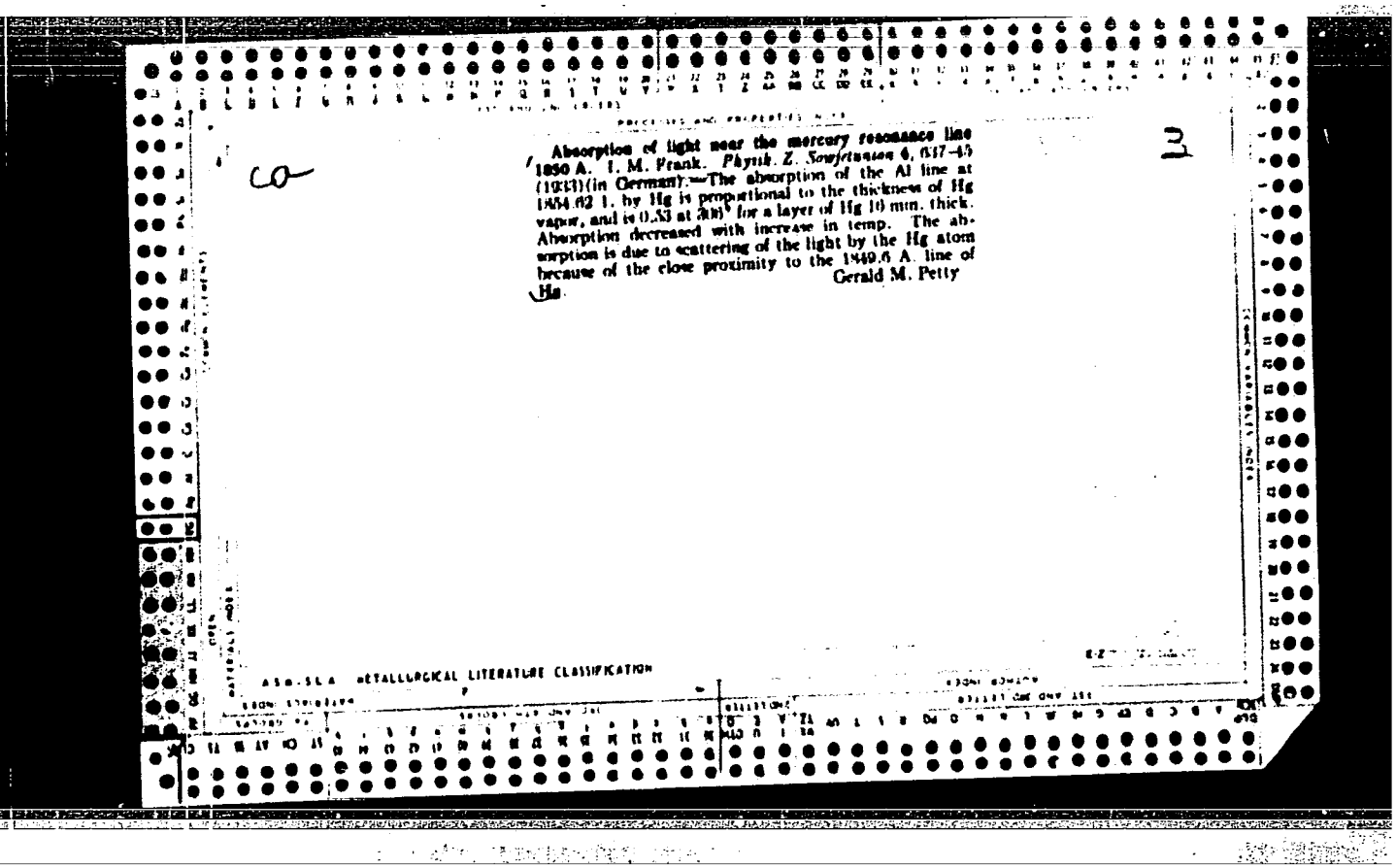


PROCESSES AND PROPERTIES INDEX

Oxidation of mercury vapors under the influence of ultra-violet light. I. M. Frank. *Compt. rend. acad. sci. U. R. S. S.* [N. S.], 1935, 146–7(in English 147–8); cf. Dickinson and Sherrill, *C. A.* 20, 1954; Noyes, *C. A.* 22, 2717; 23, 3165; Leipunskii and Sagulin, *C. A.* 23, 1054, 5089.—In the oxidation of Hg vapors with O under the influence of ultra-violet, *e. g.*, exciting the Hg atoms with the line 2537 A., the reaction may follow the following course: $Hg^0 + O_2 \rightarrow Hg + O_2^*$; $O_2^* + O_2 \rightarrow O_3 + O$; $O_3 + Hg \rightarrow HgO + O_2$, where O_2^* is an excited mol. in the state $^2\Sigma$ or $^2\Sigma$. The expt. procedure carried out under sub-atm. pressure measured manometrically confirmed this assumption. The removal of short-wave light from the exciting rays has no effect on the reaction, but a decrease in the exciting rays has an adverse effect. The most effective lines are those of Al at 1990, 1935 and 1900 A., which induce the formation of O_3 and Hg is not needed under the above conditions provided that some O_3 is already produced.

A. A. Boehtlingk

A.S.M.-S.L.A. METALLURGICAL LITERATURE CLASSIFICATION



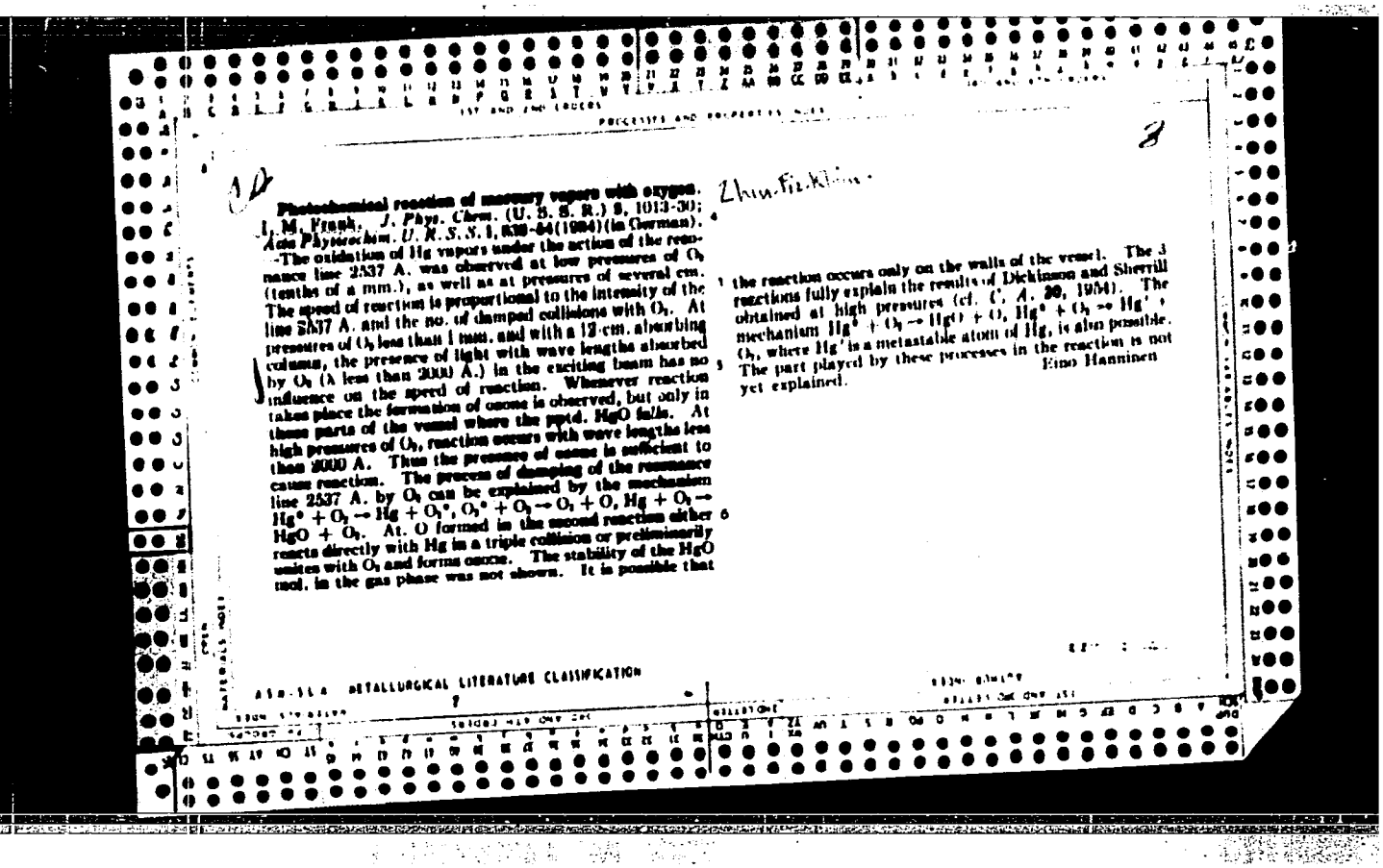
Absorption of light near the mercury resonance line 1850 A. I. M. Frank. *Physik. Z. Sowjetunion* 4, 617–44 (1933)(in German).—The absorption of the Al line at 1854.02 I. by Hg is proportional to the thickness of Hg vapor, and is 0.53 at 20° for a layer of Hg 10 mm. thick. Absorption decreased with increase in temp. The absorption is due to scattering of the light by the Hg atom because of the close proximity to the 1849.6 A. line of Hg.

Gerald M. Petty

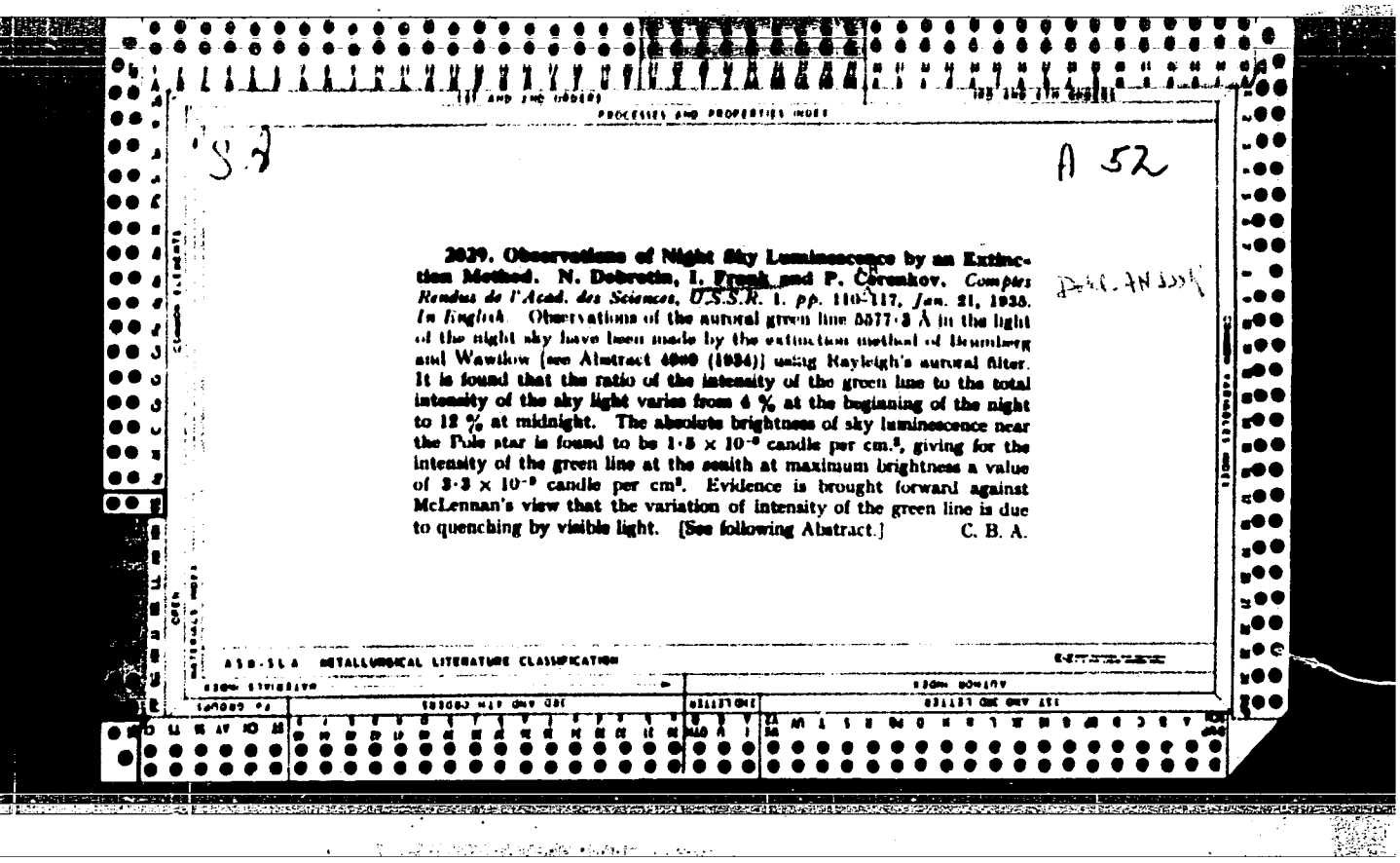
CO

3

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



Photochemical reaction of mercury vapors with oxygen. L. M. Frank. *J. Phys. Chem.* (U. S. S. R.) 9, 1013-30; *Acta Physicochim. U. R. S. S.* 1, 839-64 (1934) (in German). —The oxidation of Hg vapors under the action of the resonance line 2537 A. was observed at low pressures of O_2 (tenths of a mm.), as well as at pressures of several cm. The speed of reaction is proportional to the intensity of the line 2537 A. and the no. of damped collisions with O_2. At pressures of O_2 less than 1 mm. and with a 12-cm. absorbing column, the presence of light with wave lengths absorbed by O_2 (λ less than 2000 A.) in the exciting beam has no influence on the speed of reaction. Whenever reaction takes place the formation of ozone is observed, but only in those parts of the vessel where the ppt'd. HgO fails. At high pressures of O_2, reaction occurs with wave lengths less than 2000 A. Thus the presence of ozone is sufficient to cause reaction. The process of damping of the resonance line 2537 A. by O_2 can be explained by the mechanism $Hg^0 + O_2 \rightarrow Hg + O_2^0$, $O_2^0 + O_2 \rightarrow O_3 + O$, $Hg + O_3 \rightarrow HgO + O_2$. At. O formed in the second reaction either reacts directly with Hg in a triple collision or preliminarily unites with O_2 and forms ozone. The stability of the HgO mol. in the gas phase was not shown. It is possible that the reaction occurs only on the walls of the vessel. The 3 reactions fully explain the results of Dickinson and Sherrill obtained at high pressures (cf. *C. A.* 30, 1954). The mechanism $Hg^0 + O_2 \rightarrow Hg(?) + O$, $Hg^0 + O_2 \rightarrow Hg' + O_2$, where Hg' is a metastable atom of Hg, is also possible. The part played by these processes in the reaction is not yet explained. Eino Hanninen



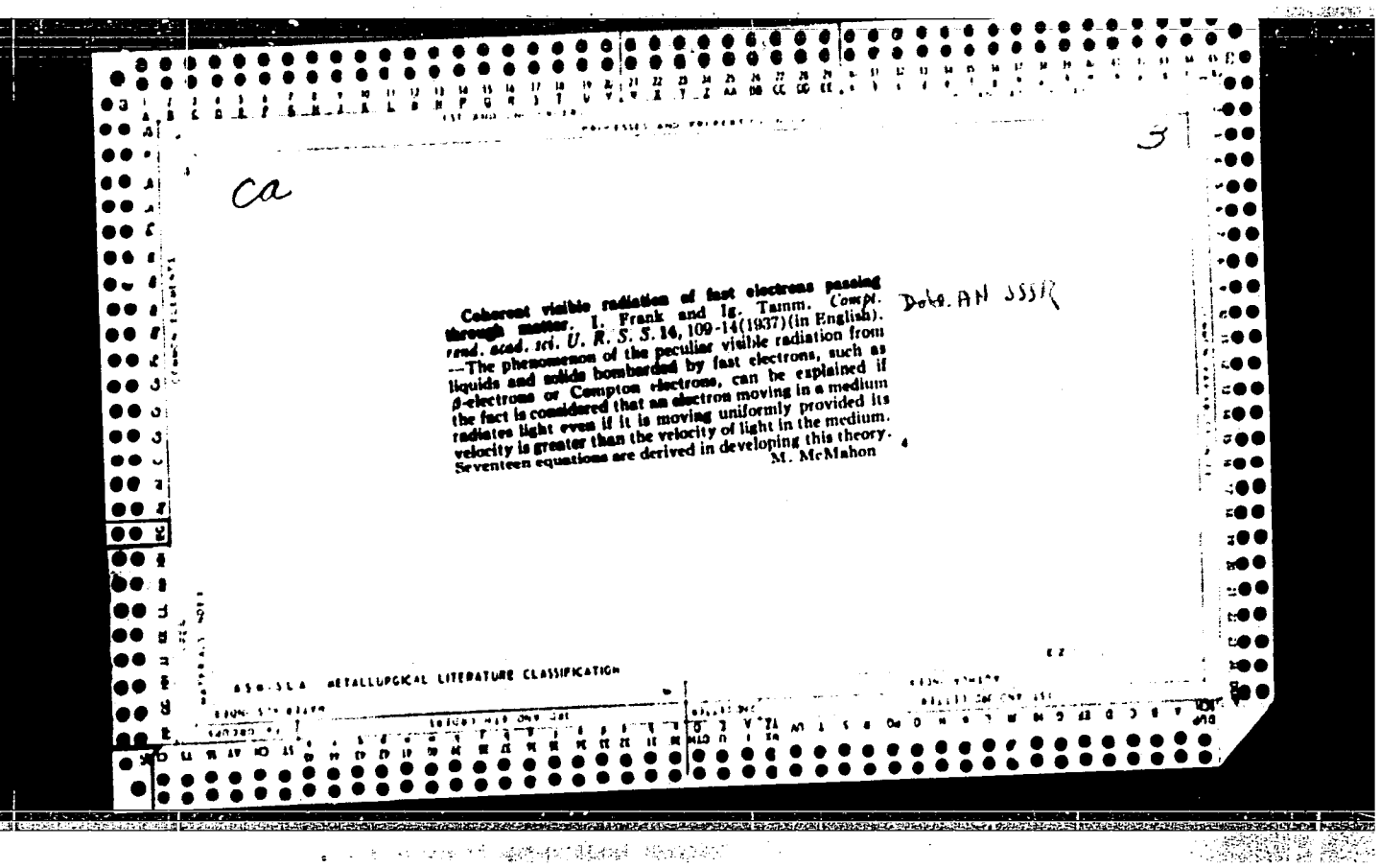
PROCESSES AND PROPERTIES INDEX

S.2

A 52

2029. Observations of Night Sky Luminescence by an Extinction Method. N. Dobrotin, I. Frank and P. Cherenkov. *Comptes Rendus de l'Acad. des Sciences, U.S.S.R.* 1. *pp.* 110–117, *Jan.* 21, 1935. *In English.* Observations of the auroral green line 5577·3 Å in the light of the night sky have been made by the extinction method of Dumbleton and Wawilow [see Abstract 4000 (1934)] using Rayleigh's auroral filter. It is found that the ratio of the intensity of the green line to the total intensity of the sky light varies from 4 % at the beginning of the night to 12 % at midnight. The absolute brightness of sky luminescence near the Pole star is found to be $1{\cdot}5 \times 10^{-9}$ candle per cm.^{2}, giving for the intensity of the green line at the zenith at maximum brightness a value of $3{\cdot}3 \times 10^{-9}$ candle per cm^2. Evidence is brought forward against McLennan's view that the variation of intensity of the green line is due to quenching by visible light. [See following Abstract.] C. B. A.

A 52-5 A METALLURGICAL LITERATURE CLASSIFICATION



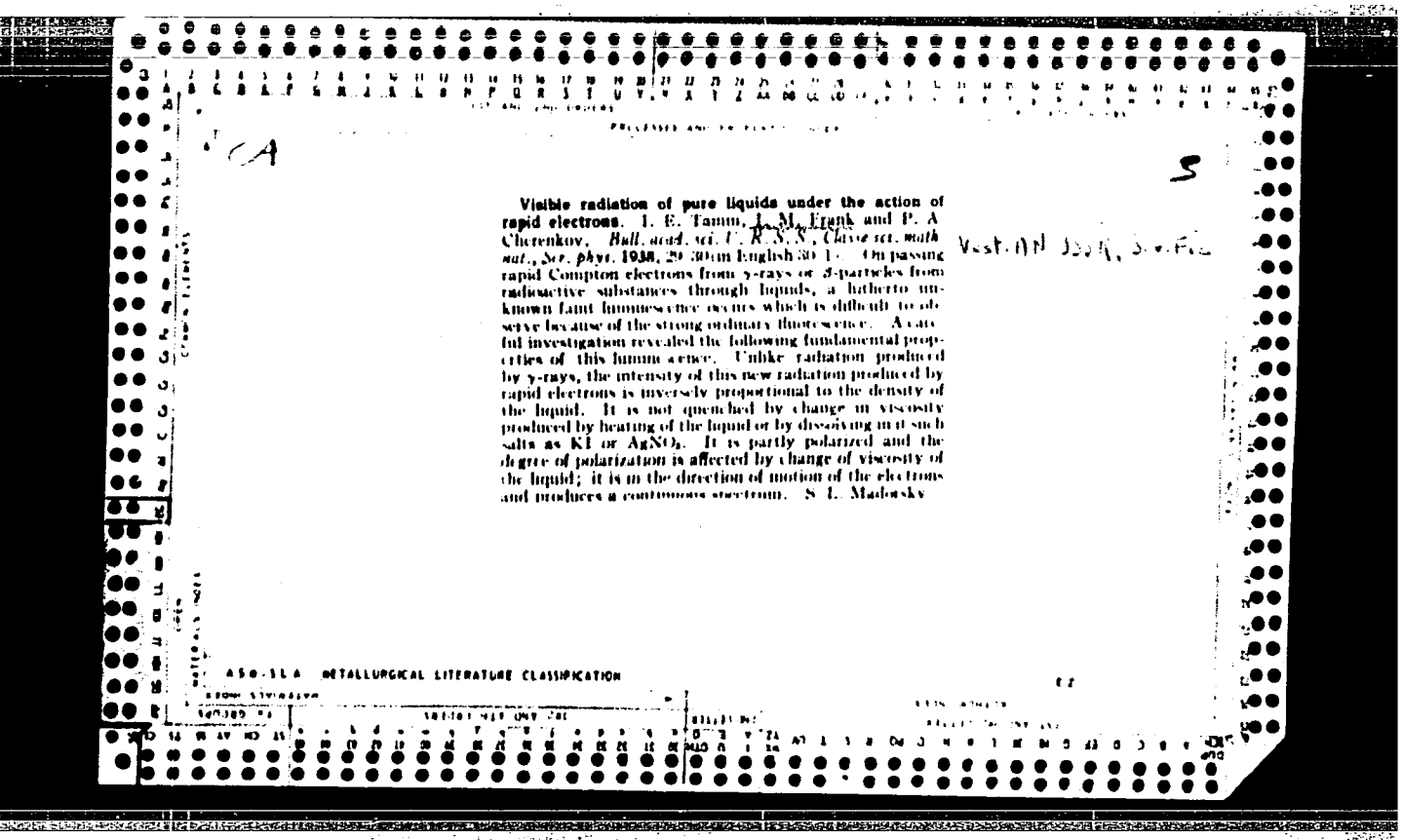
Ca

3

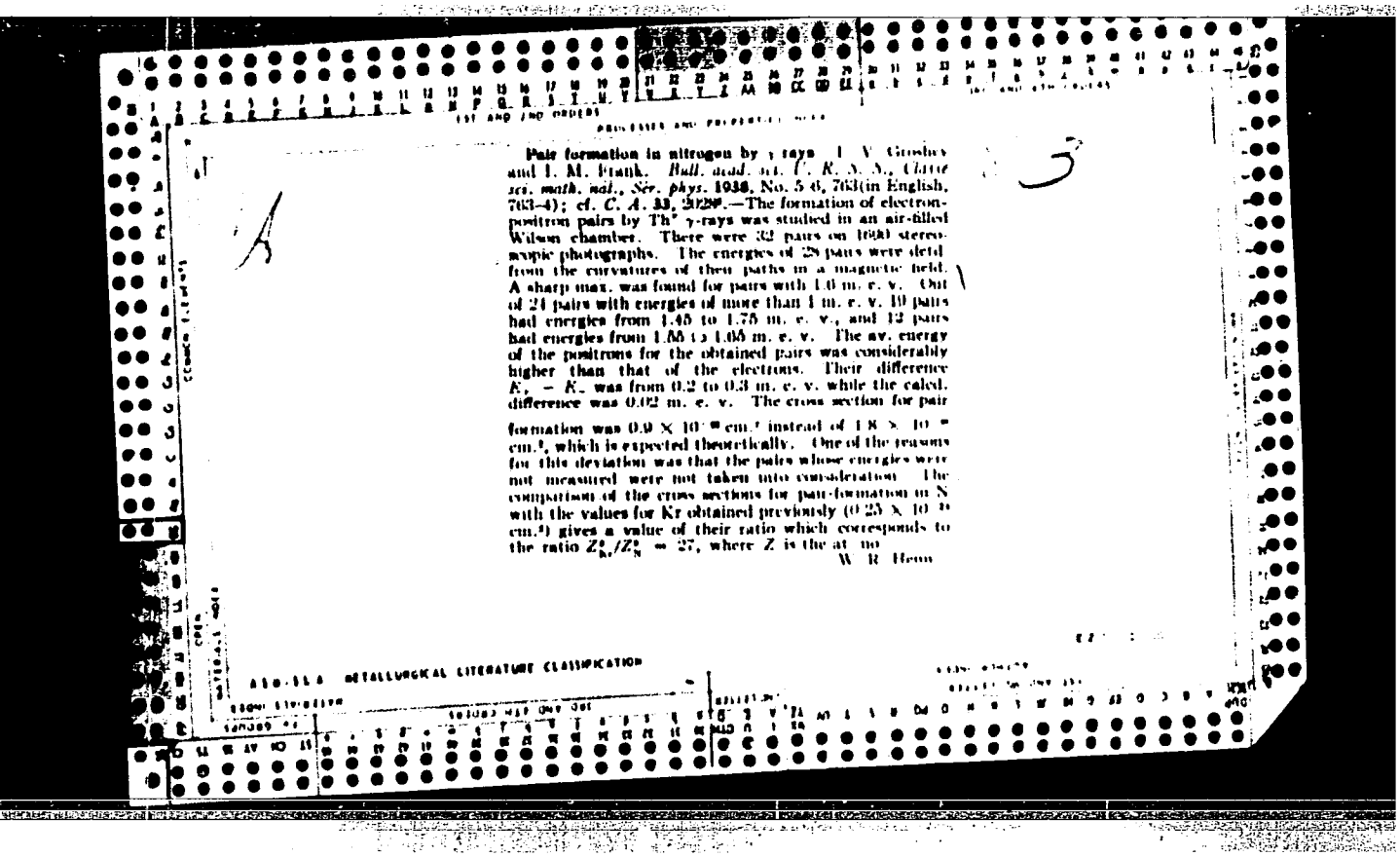
Coherent visible radiation of fast electrons passing through matter. I. Frank and Ig. Tamm. *Compt. rend. acad. sci. U. R. S. S.* 14, 109-14(1937)(in English). --The phenomenon of the peculiar visible radiation from liquids and solids bombarded by fast electrons, such as β-electrons or Compton electrons, can be explained if the fact is considered that an electron moving in a medium radiates light even if it is moving uniformly provided its velocity is greater than the velocity of light in the medium. Seventeen equations are derived in developing this theory. M. McMahon

Doklady AN SSSR

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

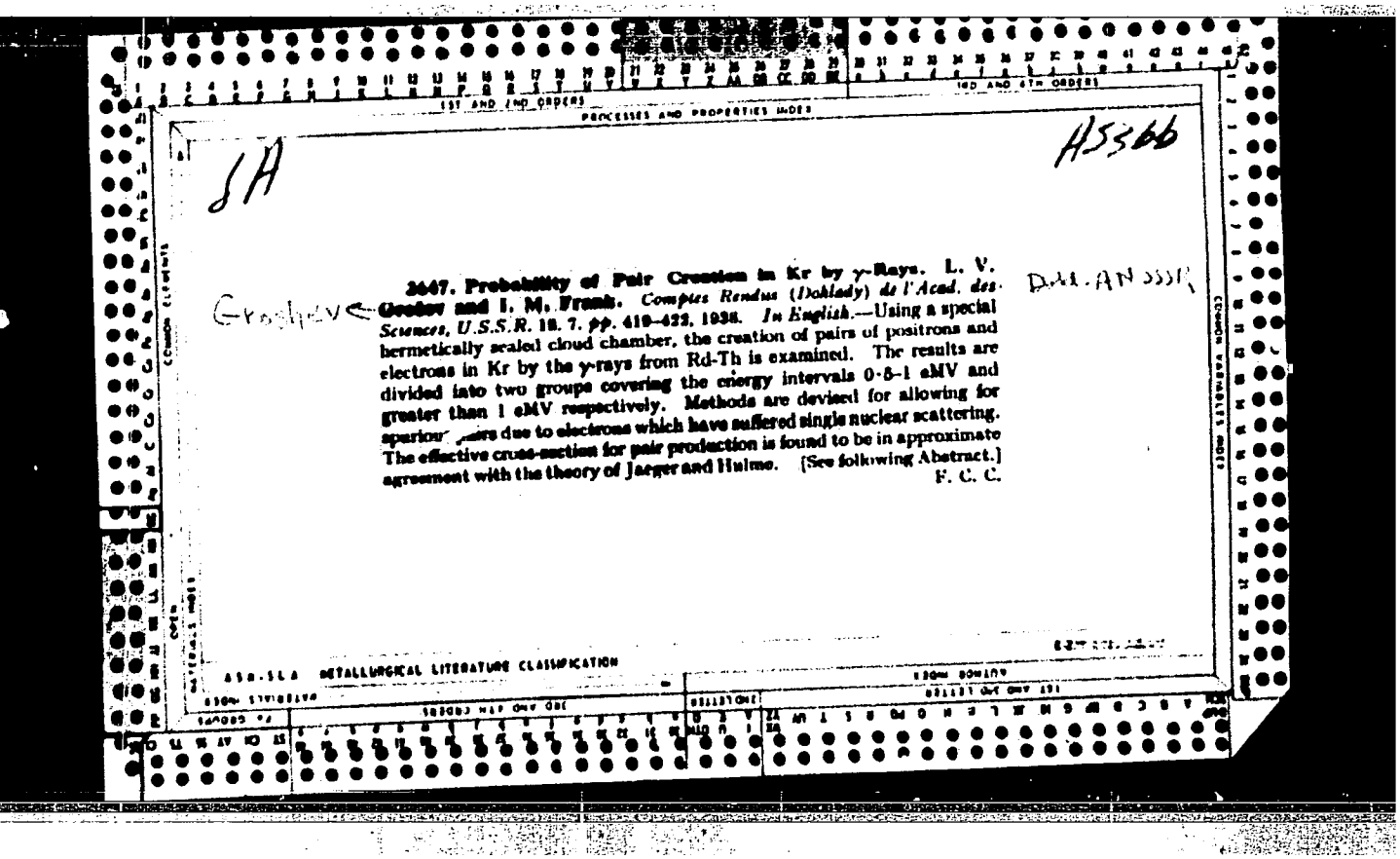


Visible radiation of pure liquids under the action of rapid electrons. I. E. Tamm, I. M. Frank and P. A. Cherenkov. *Bull. acad. sci. U. R. S. S., Classe sci. math nat., Sér. phys.* **1938**, 2: 30 pp in English 30 1. On passing rapid Compton electrons from γ-rays or β-particles from radioactive substances through liquids, a hitherto unknown faint luminescence occurs which is difficult to observe because of the strong ordinary fluorescence. A careful investigation revealed the following fundamental properties of this luminescence. Unlike radiation produced by γ-rays, the intensity of this new radiation produced by rapid electrons is inversely proportional to the density of the liquid. It is not quenched by change in viscosity produced by heating of the liquid or by dissolving in it such salts as KI or $AgNO_3$. It is partly polarized and the degree of polarization is affected by change of viscosity of the liquid; it is in the direction of motion of the electrons and produces a continuous spectrum. S. L. Madorsky



Pair formation in nitrogen by γ rays. I. V. Groshev and I. M. Frank. *Bull. acad. sci. U. R. S. S., Classe sci. math. nat., Sér. phys.* **1938**, No. 5/6, 763(in English, 763–4); cf. *C. A.* **33**, 2028⁹.—The formation of electron-positron pairs by Th″ γ-rays was studied in an air-filled Wilson chamber. There were 32 pairs on 1693 stereoscopic photographs. The energies of 28 pairs were detd. from the curvatures of their paths in a magnetic field. A sharp max. was found for pairs with 1.0 m. e. v. Out of 24 pairs with energies of more than 1 m. e. v. 10 pairs had energies from 1.45 to 1.75 m. e. v., and 12 pairs had energies from 1.85 to 1.95 m. e. v. The av. energy of the positrons for the obtained pairs was considerably higher than that of the electrons. Their difference $K_+ - K_-$ was from 0.2 to 0.3 m. e. v. while the calcd. difference was 0.02 m. e. v. The cross section for pair formation was 0.9×10^{-28} cm.² instead of 1.8×10^{-28} cm.², which is expected theoretically. One of the reasons for this deviation was that the pairs whose energies were not measured were not taken into consideration. The comparison of the cross sections for pair-formation in N with the values for Kr obtained previously (0.25×10^{-28} cm.²) gives a value of their ratio which corresponds to the ratio $Z_{Kr}^2/Z_N^2 = 27$, where Z is the at. no.

W. R. Heun



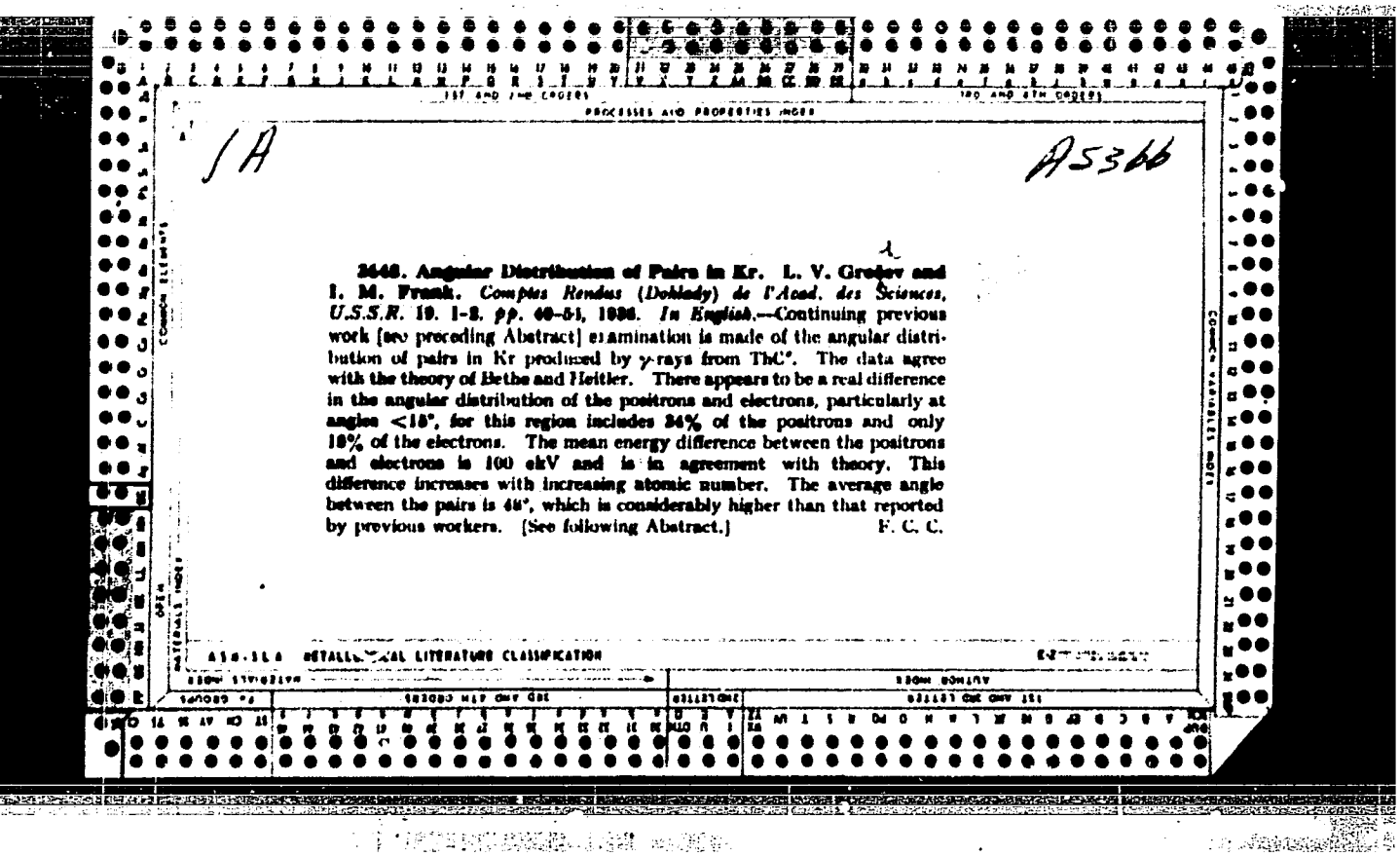
8A

H5566

Grosheva

DAN SSSR

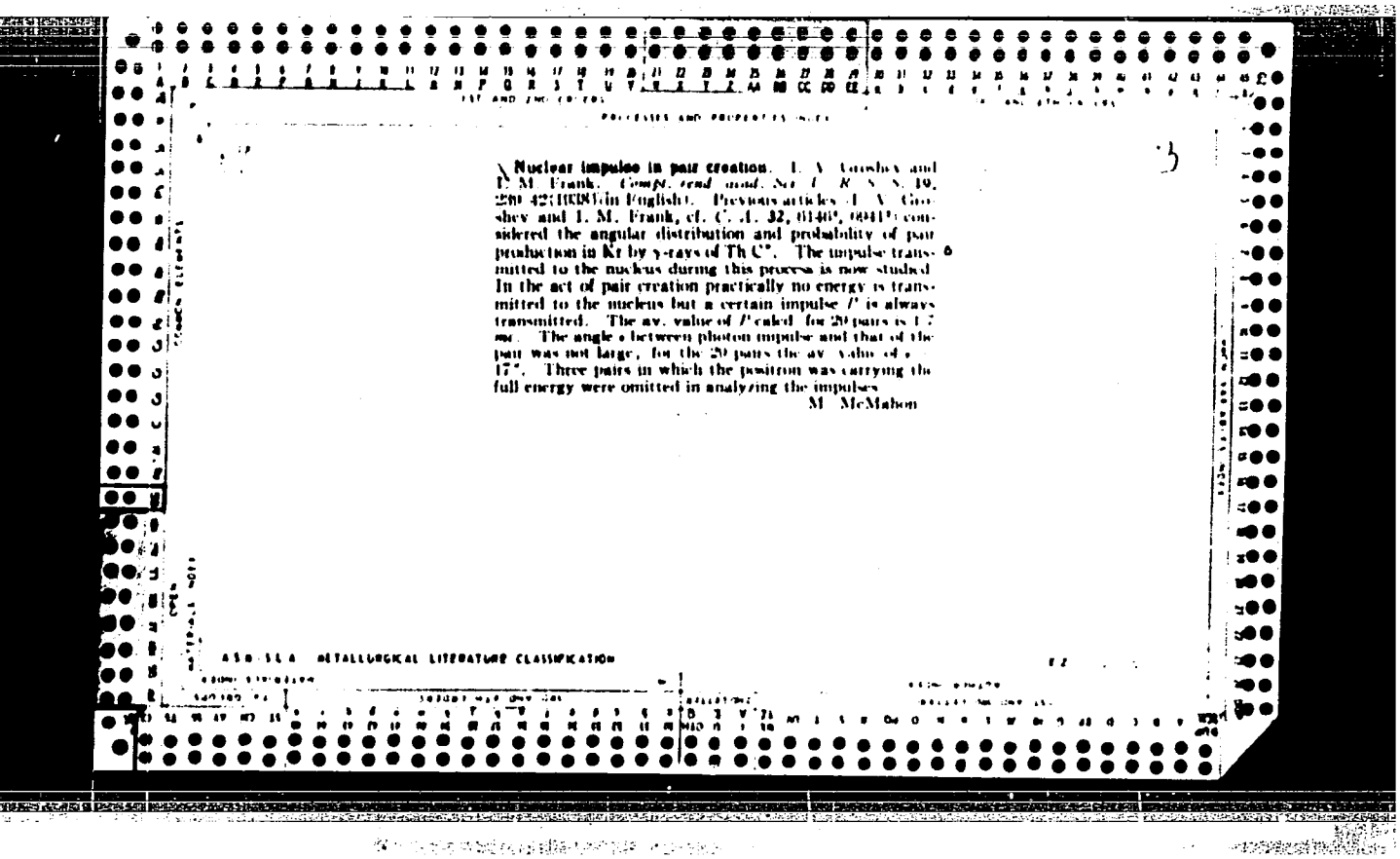
2667. Probability of Pair Creation in Kr by γ-Rays. L. V. Groshev and I. M. Frank. *Comptes Rendus (Doklady) de l'Acad. des Sciences, U.S.S.R.* **18.** 7. *pp.* 419–422, 1938. *In English.*—Using a special hermetically sealed cloud chamber, the creation of pairs of positrons and electrons in Kr by the γ-rays from Rd-Th is examined. The results are divided into two groups covering the energy intervals 0·8–1 eMV and greater than 1 eMV respectively. Methods are devised for allowing for spurious pairs due to electrons which have suffered single nuclear scattering. The effective cross-section for pair production is found to be in approximate agreement with the theory of Jaeger and Hulme. [See following Abstract.]
F. C. C.



/A

A5366

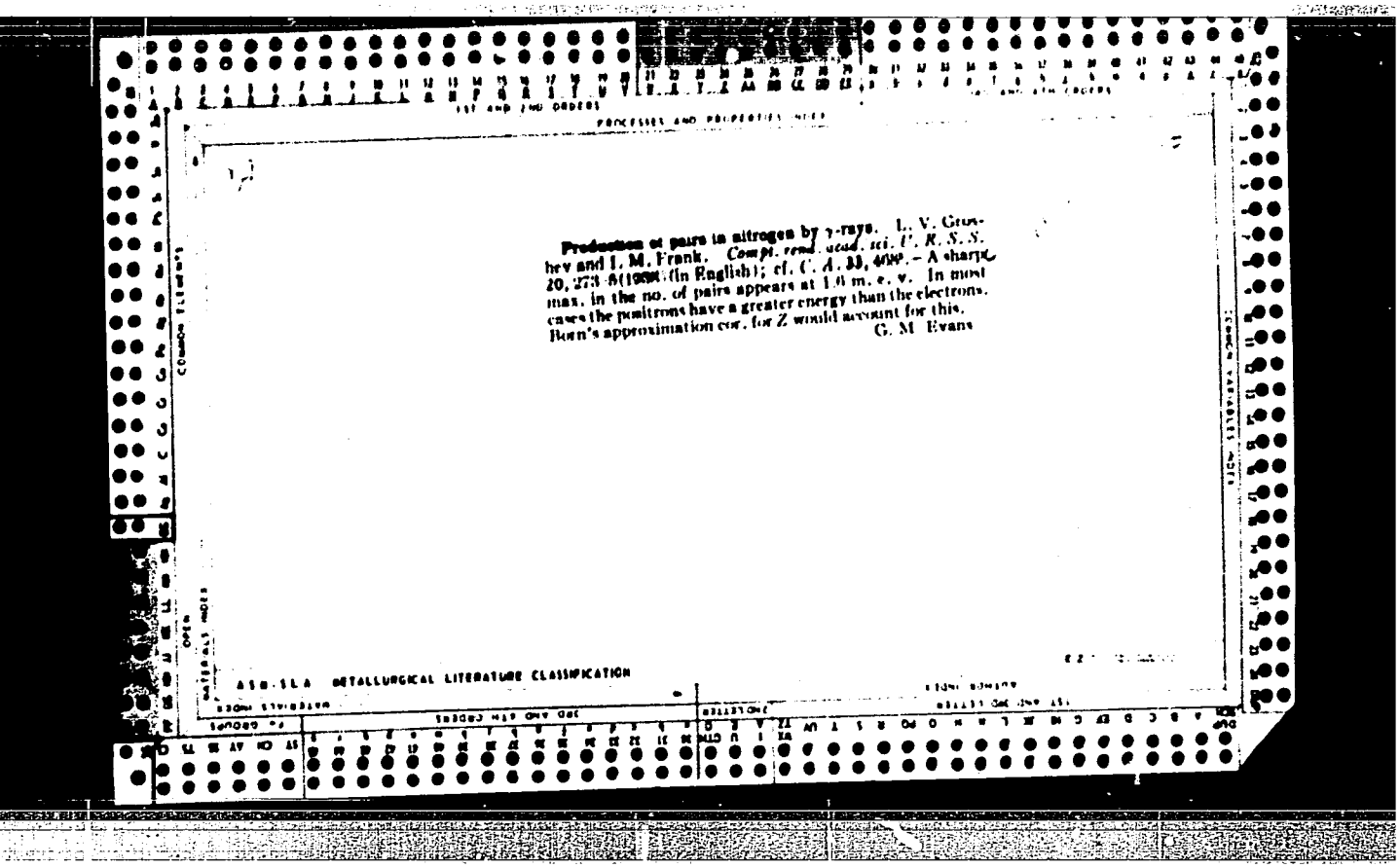
2448. Angular Distribution of Pairs in Kr. L. V. Groshev and I. M. Frank. *Comptes Rendus (Doklady) de l'Acad. des Sciences, U.S.S.R.* 19. 1-2. pp. 49-51, 1938. *In English.*—Continuing previous work [see preceding Abstract] examination is made of the angular distribution of pairs in Kr produced by γ-rays from ThC''. The data agree with the theory of Bethe and Heitler. There appears to be a real difference in the angular distribution of the positrons and electrons, particularly at angles $<15°$, for this region includes 34% of the positrons and only 10% of the electrons. The mean energy difference between the positrons and electrons is 100 ekV and is in agreement with theory. This difference increases with increasing atomic number. The average angle between the pairs is 46°, which is considerably higher than that reported by previous workers. [See following Abstract.] F. C. C.



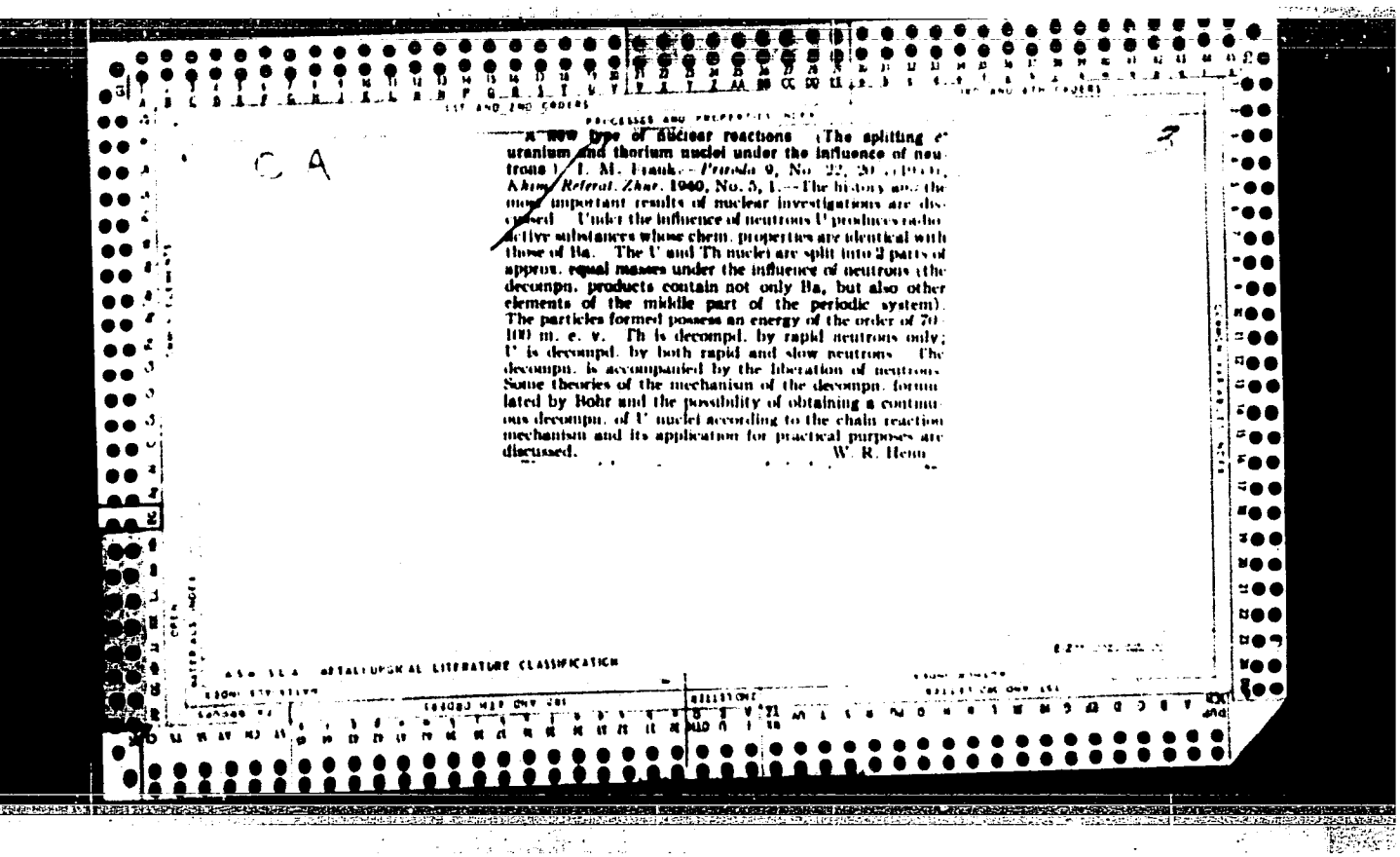
Nuclear impulse in pair creation. I. V. Gurshev and I. M. Frank. *Compt. rend. acad. Sci. U. R. S. S.* 19, 239-42(1938)(in English). Previous articles I. V. Gurshev and I. M. Frank, cf. *C. A.* 32, 6140⁸, 6941⁹; considered the angular distribution and probability of pair production in Kr by γ-rays of Th C″. The impulse transmitted to the nucleus during this process is now studied. In the act of pair creation practically no energy is transmitted to the nucleus but a certain impulse P is always transmitted. The av. value of P calcd. for 20 pairs is 1.7 mc. The angle ϑ between photon impulse and that of the pair was not large; for the 20 pairs the av. value of ϑ is 17°. Three pairs in which the positron was carrying the full energy were omitted in analyzing the impulses.

M. McMahon

A50-51A METALLURGICAL LITERATURE CLASSIFICATION



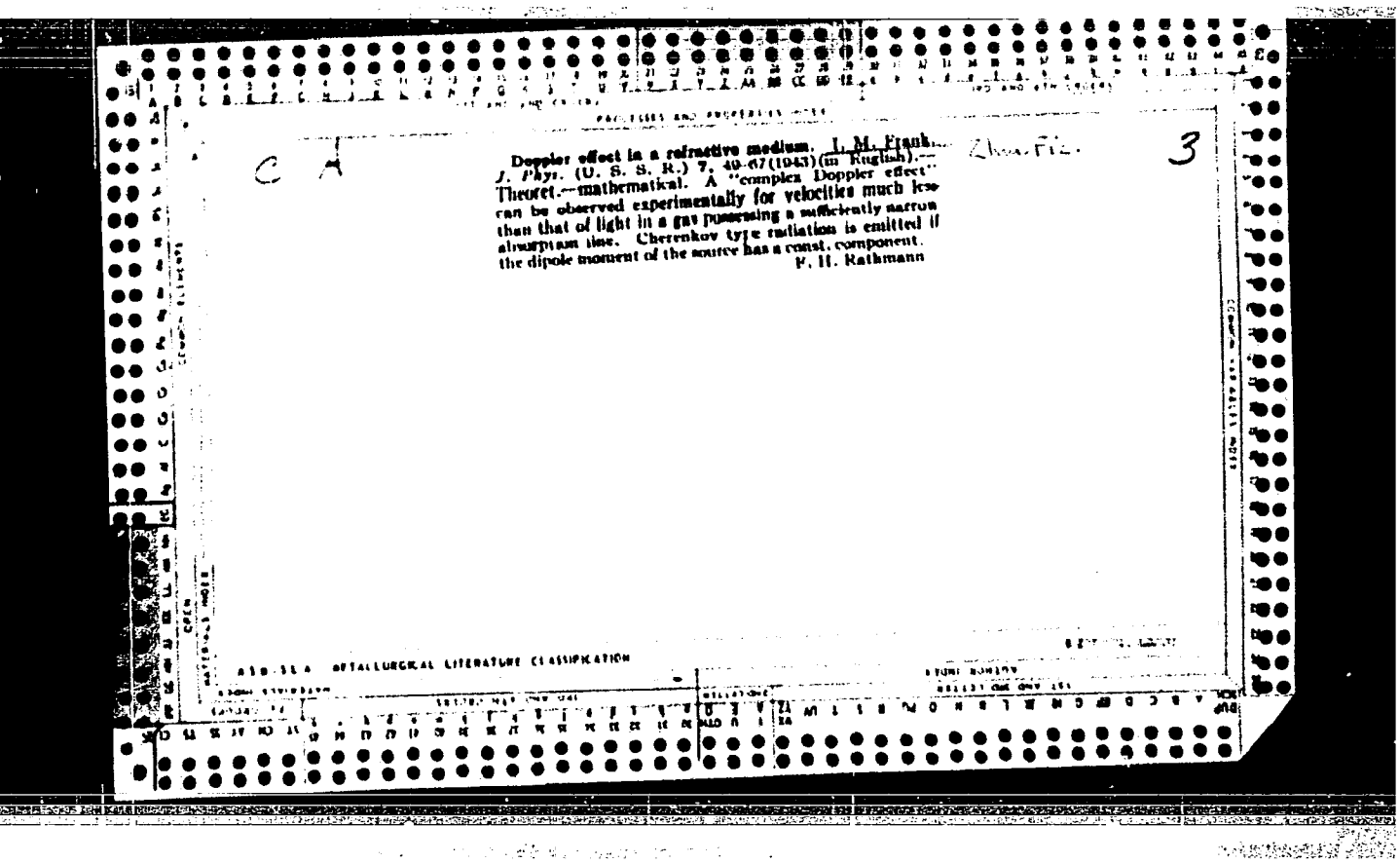
Production of pairs in nitrogen by γ-rays. L. V. Grosshev and I. M. Frank. *Compt. rend. acad. sci. U. R. S. S.* 20, 273–6 (1938) (in English); cf. *C. A.* 33, 4098⁹. – A sharp max. in the no. of pairs appears at 1.0 m. e. v. In most cases the positrons have a greater energy than the electrons. Born's approximation cor. for Z would account for this.
G. M. Evans



C A

A new type of nuclear reactions (The splitting of uranium and thorium nuclei under the influence of neutrons.) I. M. Frank. *Priroda* 9, No. 22, 30 (1960). *Khim. Referat. Zhur.* 1960, No. 5, 1.—The history and the most important results of nuclear investigations are discussed. Under the influence of neutrons U produces radioactive substances whose chem. properties are identical with those of Ba. The U and Th nuclei are split into 2 parts of approx. equal masses under the influence of neutrons (the decompn. products contain not only Ba, but also other elements of the middle part of the periodic system). The particles formed possess an energy of the order of 70-100 m. e. v. Th is decompd. by rapid neutrons only; U is decompd. by both rapid and slow neutrons. The decompn. is accompanied by the liberation of neutrons. Some theories of the mechanism of the decompn. formulated by Bohr and the possibility of obtaining a continuous decompn. of U nuclei according to the chain reaction mechanism and its application for practical purposes are discussed.

W. R. Henn



C A

Doppler effect in a refractive medium. I. M. Frank. Zhur. Fiz. 3
J. Phys. (U. S. S. R.) 7, 49-67 (1943) (in English).—
Theoret.—mathematical. A "complex Doppler effect"
can be observed experimentally for velocities much less
than that of light in a gas possessing a sufficiently narrow
absorption line. Cherenkov type radiation is emitted if
the dipole moment of the source has a const. component.
P. H. Rathmann

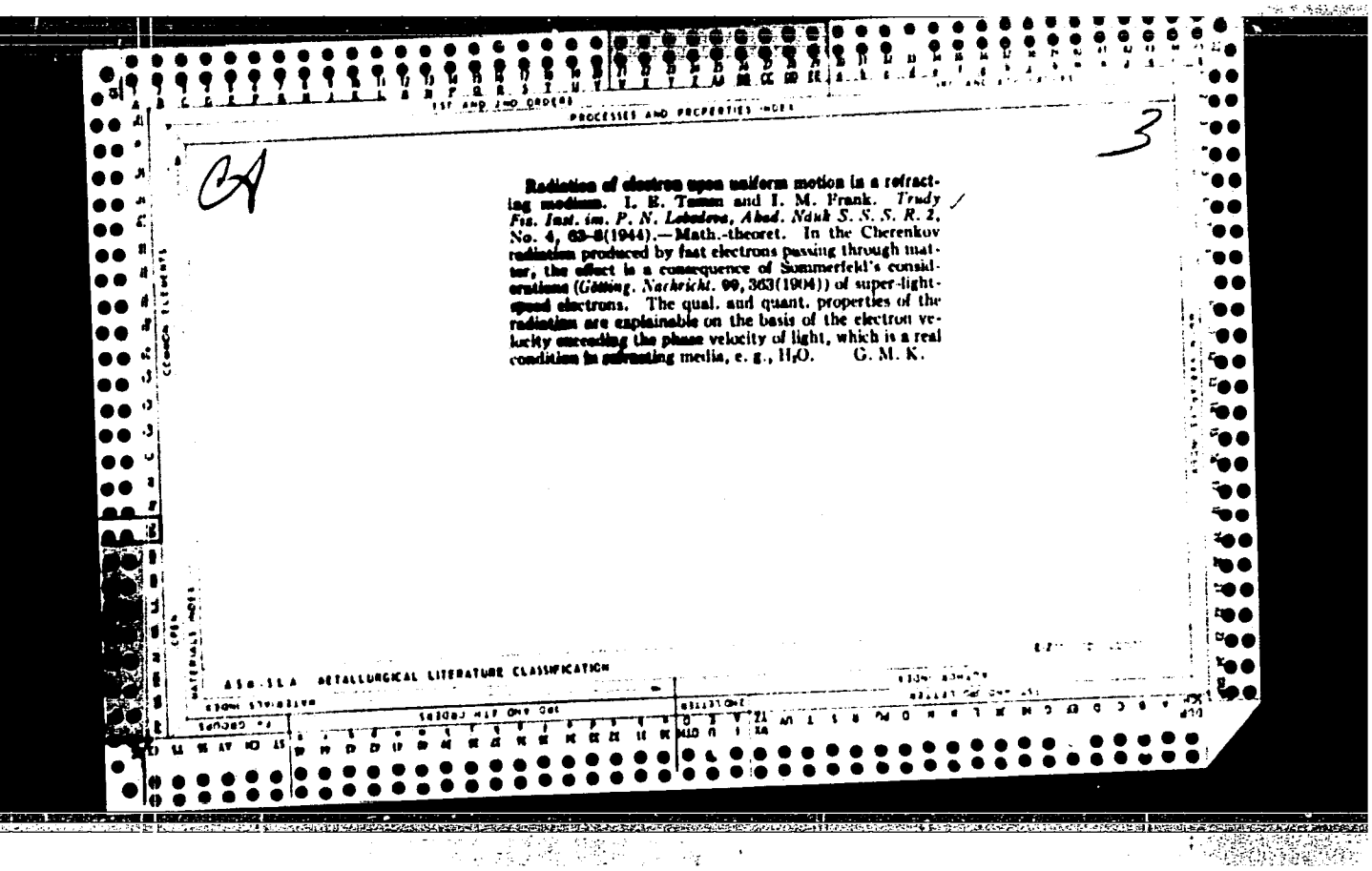
A10-51A METALLURGICAL LITERATURE CLASSIFICATION

FRANK, I. M.

"Radiation Receiver with Reduced Sensitivity to the Position of the Source," Dok AN USSR, 39, No 2, 1943. Physics Inst. im. Lebedev, AS USSR

FRANK, I. M.

"Interference Phenomena in the Case of Cherenkov Radiation," Dok AN USSR, 42, No.8, 1943. Phys. Inst. im. Lebedev, AS USSR

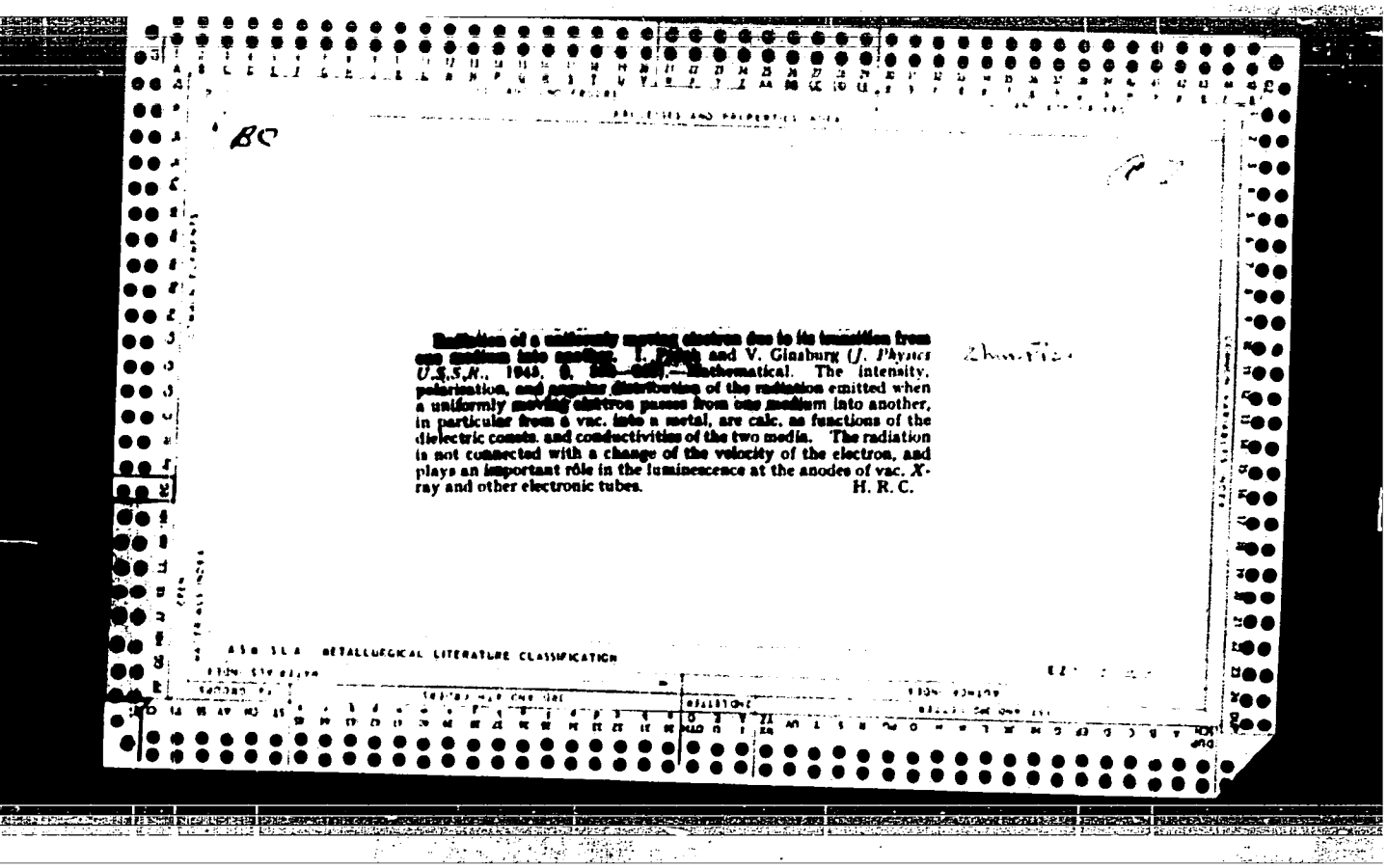


CA

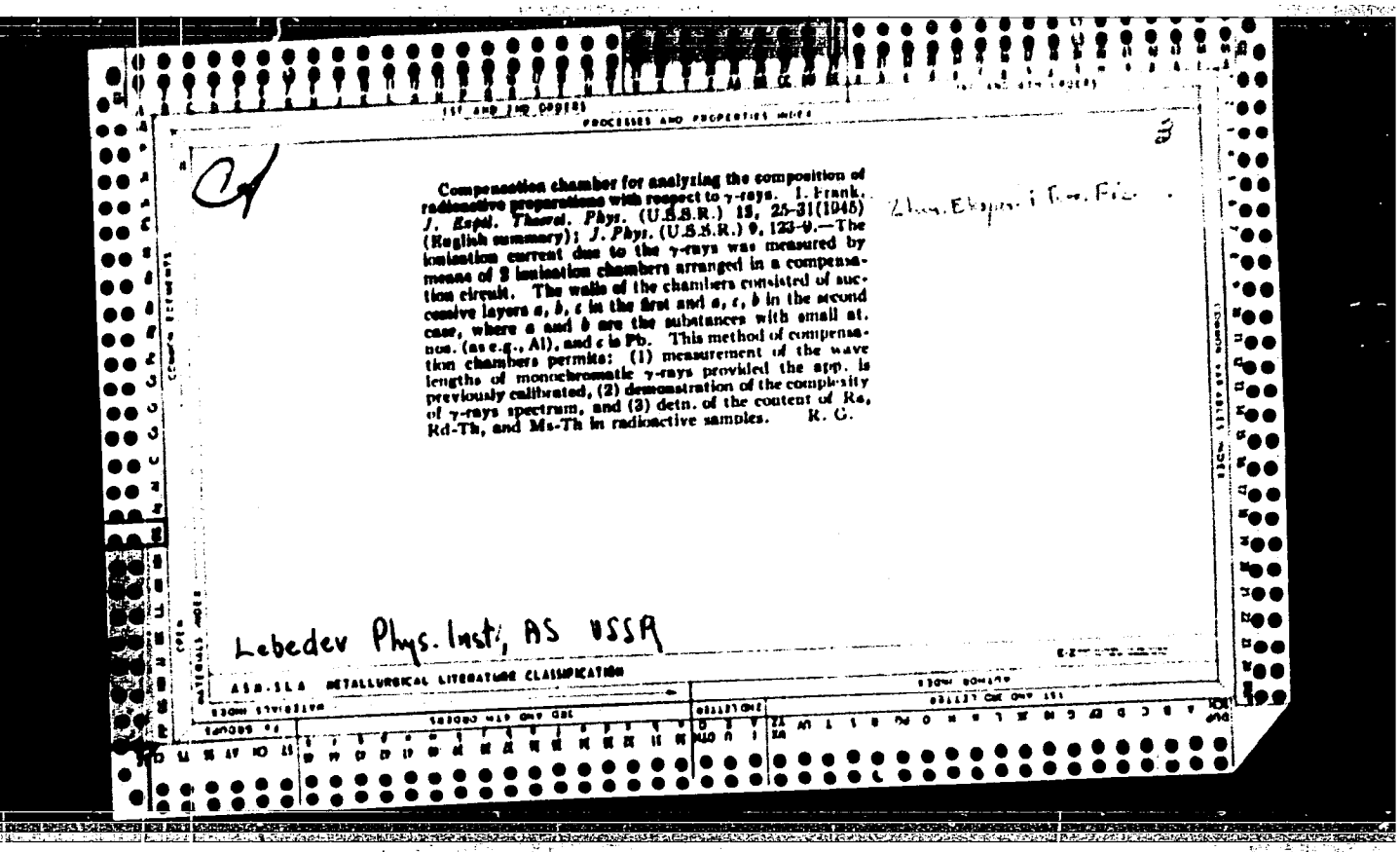
3

Radiation of electron upon uniform motion in a refracting medium. I. E. Tamm and I. M. Frank. *Trudy Fiz. Inst. im. P. N. Lebedeva, Akad. Nauk S. S. S. R.* 2, No. 4, 63–8(1944).—Math.-theoret. In the Cherenkov radiation produced by fast electrons passing through matter, the effect is a consequence of Sommerfeld's considerations (*Götting. Nachricht.* 99, 363(1904)) of super-light-speed electrons. The qual. and quant. properties of the radiation are explainable on the basis of the electron velocity exceeding the phase velocity of light, which is a real condition in refracting media, e. g., H_2O. G. M. K.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



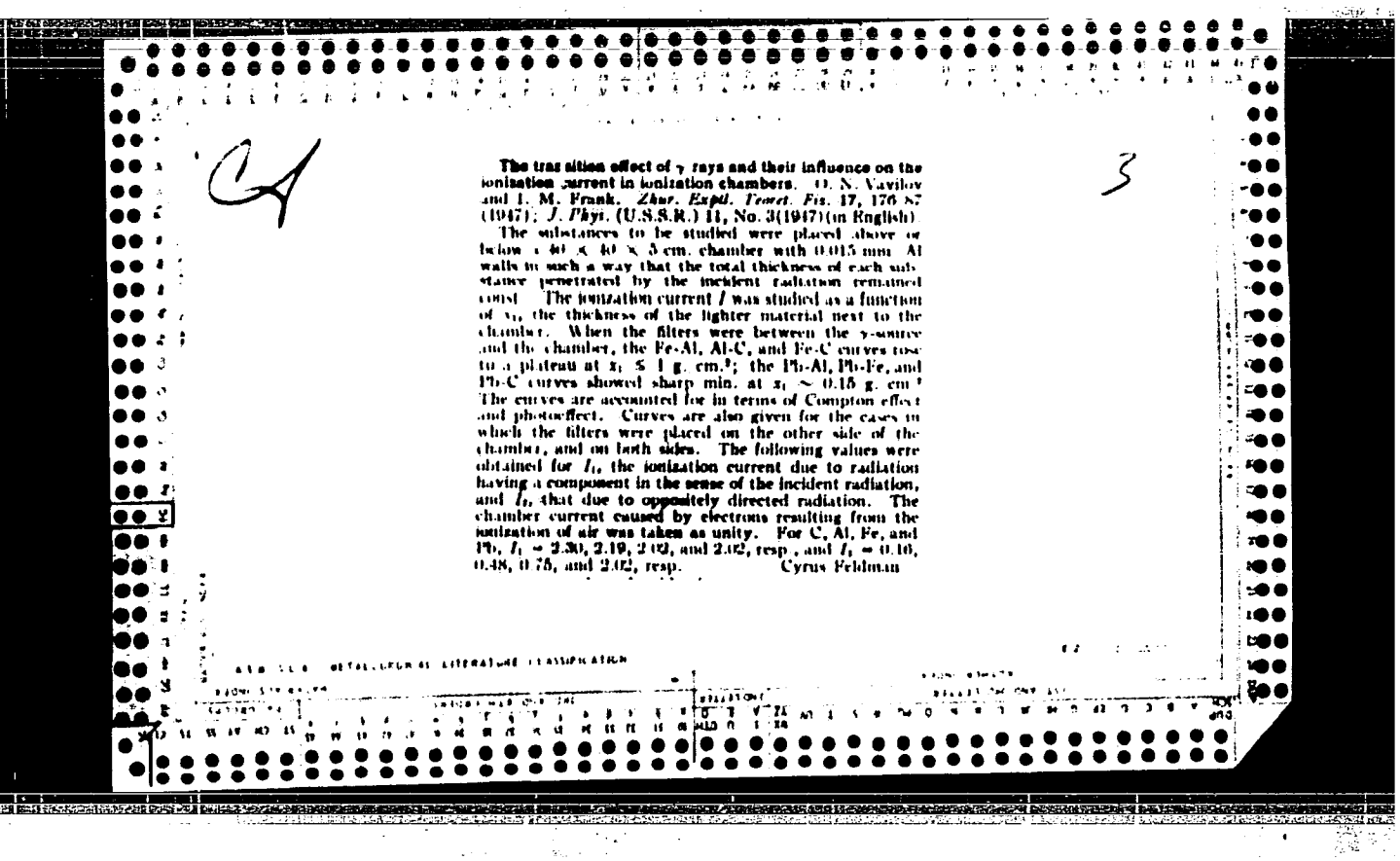
Radiation of a uniformly moving electron due to its transition from one medium into another. I. Frank and V. Ginzburg (*J. Physics U.S.S.R.*, 1945, 9, 353–362).—Mathematical. The intensity, polarisation, and angular distribution of the radiation emitted when a uniformly moving electron passes from one medium into another, in particular from a vac. into a metal, are calc. as functions of the dielectric consts. and conductivities of the two media. The radiation is not connected with a change of the velocity of the electron, and plays an important rôle in the luminescence at the anodes of vac. *X*-ray and other electronic tubes. H. R. C.



Compensation chamber for analyzing the composition of radioactive preparations with respect to γ-rays. I. Frank. *J. Exptl. Theoret. Phys.* (U.S.S.R.) 15, 25-31(1945) (English summary); *J. Phys.* (U.S.S.R.) 9, 123-9.—The ionization current due to the γ-rays was measured by means of 2 ionization chambers arranged in a compensation circuit. The walls of the chambers consisted of successive layers *a*, *b*, *c* in the first and *a*, *c*, *b* in the second case, where *a* and *b* are the substances with small at. nos. (as e.g., Al), and *c* is Pb. This method of compensation chambers permits: (1) measurement of the wave lengths of monochromatic γ-rays provided the app. is previously calibrated, (2) demonstration of the complexity of γ-rays spectrum, and (3) detn. of the content of Ra, Rd-Th, and Ms-Th in radioactive samples. K. G.

Lebedev Phys. Inst, AS USSR

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



The transition effect of γ rays and their influence on the ionisation current in ionization chambers. P. N. Vavilov and I. M. Frank. *Zhur. Eksptl. Teoret. Fiz.* 17, 176–87 (1947); *J. Phys.* (U.S.S.R.) 11, No. 3(1947)(in English).

The substances to be studied were placed above or below a 40 × 40 × 5 cm. chamber with 0.015 mm. Al walls in such a way that the total thickness of each substance penetrated by the incident radiation remained const. The ionization current I was studied as a function of x_1, the thickness of the lighter material next to the chamber. When the filters were between the γ-source and the chamber, the Fe-Al, Al-C, and Fe-C curves rose to a plateau at $x_1 \leq 1$ g. cm.$^{-2}$; the Pb-Al, Pb-Fe, and Pb-C curves showed sharp min. at $x_1 \sim 0.15$ g. cm.$^{-2}$. The curves are accounted for in terms of Compton effect and photoeffect. Curves are also given for the cases in which the filters were placed on the other side of the chamber, and on both sides. The following values were obtained for I_1, the ionization current due to radiation having a component in the sense of the incident radiation, and I_2, that due to oppositely directed radiation. The chamber current caused by electrons resulting from the ionization of air was taken as unity. For C, Al, Fe, and Pb, I_1 = 2.30, 2.19, 2.02, and 2.02, resp., and I_2 = 0.10, 0.48, 0.78, and 2.02, resp. Cyrus Feldman

USSR/Nuclear Phys - Gamma Rays
Nuclear Phys - Impact, Electronic Feb 1947

"Angular Distribution of Electronic Pairs Produced by Gamma Rays of ThC," L. V. Groshev, I. M. Frank, Phys Inst imeni P. N. Lebedev, Acad Sci USSR, 2½ pp

"Zhur Eksper i Teoret Fiz" Vol XVII, No 2

Shows that dependence of distribution of angles between components of pairs formed by Gamma rays on the atomic number of the irradiated substance can differ, depending on method of pair registration employed. As result of this, the difference in results obtained with use of the Wilson chamber and the counters does not lead to contradiction.

FA 57T70

FRANK, I.M. and GINZBERG, V.L.

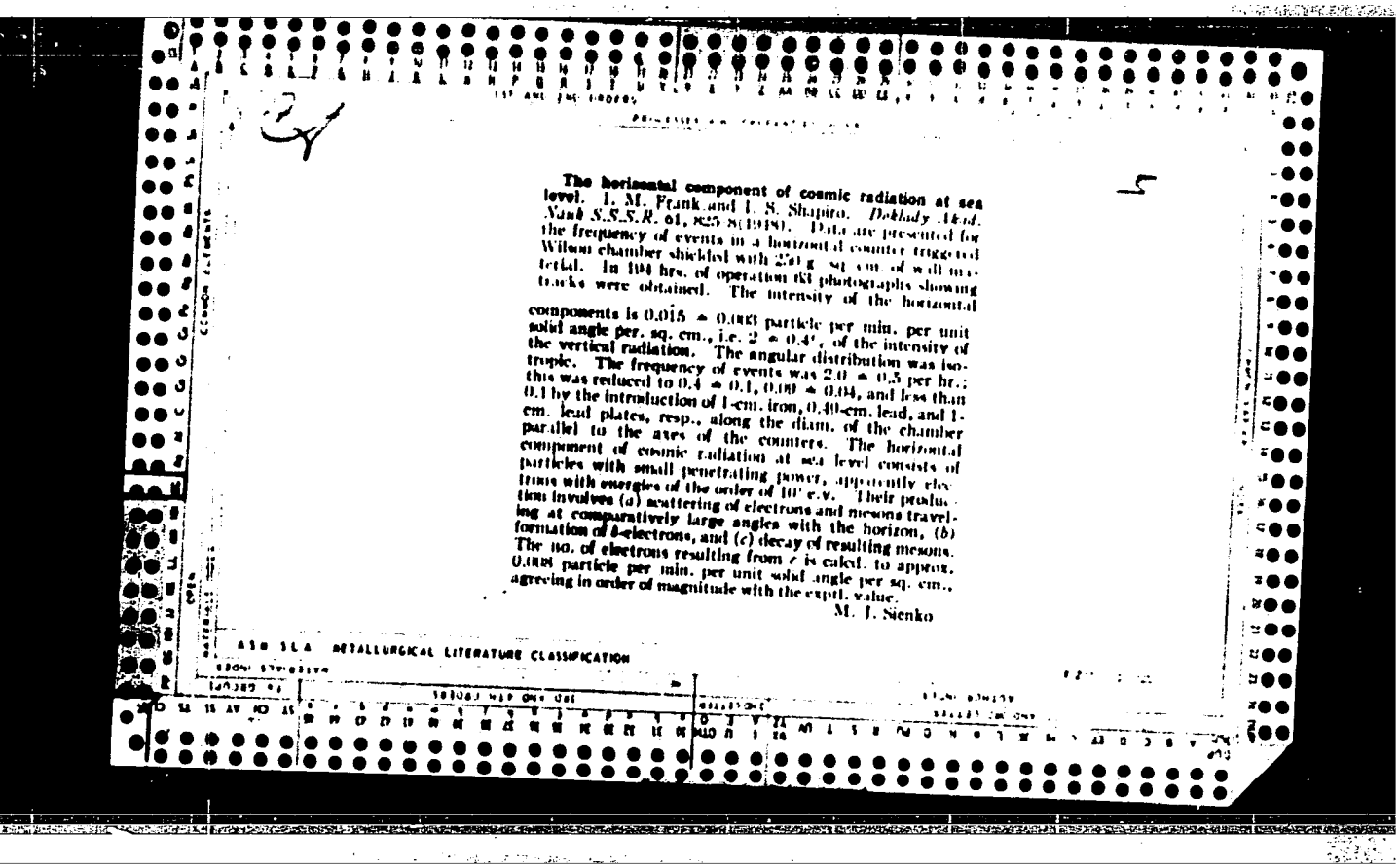
"The Doppler Effect at Super-phase Velocity." Dok. Akad. Nauk. SSSR, 56 (1947), 6, 583-586.

SO: Translation— 30 Apr 1954.

CA

The radiation from electrons and atoms which are in motion along the axis of a canal in a dense medium. V. L. Ginsburg and I. M. Frank. *Doklady Akad. Nauk S.S.S.R.* **56**, 699-702(1947); *Chem. Zentr.* (Russian Zone Ed.) **1948**, II, 158; cf. *C.A.* **43**, 11158.—A theoretical and math. discussion is presented to show that it is possible for Cherenkov radiation to be produced by an electron moving within a canal of small radius ($\rho = <\lambda$) and that it is further possible for the Doppler effect to be produced at velocities greater than that of light. The simplest case of the motion of an electron and of an atom along a canal at a velocity $v = \beta c$ is considered. If $n_1 = n_2$ (inside and outside the canal) the Cherenkov effect would be produced. It is shown that the condition $\rho < 5 \times 10^{-7}$ is not necessary for the development of this effect. The radiation of an oscillator moving with uniform velocity can be considered in exactly the same manner as that of an electron. The Doppler effect is theoretically possible at velocities greater than that of light if the electron moves along the boundary medium-vacuum at a distance $= 0.1\ \lambda$ from the medium. M. G. Moore

Translation - 2524467. 30 Apr 54



The horizontal component of cosmic radiation at sea level. I. M. Frank and I. S. Shapiro. *Doklady Akad. Nauk S.S.S.R.* 61, 825-8 (1948). Data are presented for the frequency of events in a horizontal counter triggered Wilson chamber shielded with 2.61 g. sq. cm. of soft material. In 100 hrs. of operation 63 photographs showing tracks were obtained. The intensity of the horizontal components is 0.015 ± 0.003 particle per min. per unit solid angle per. sq. cm., i.e. 2 ± 0.4%, of the intensity of the vertical radiation. The angular distribution was isotropic. The frequency of events was 2.0 ± 0.5 per hr.; this was reduced to 0.4 ± 0.1, 0.09 ± 0.04, and less than 0.1 by the introduction of 1-cm. iron, 0.40-cm. lead, and 1-cm. lead plates, resp., along the diam. of the chamber parallel to the axes of the counters. The horizontal component of cosmic radiation at sea level consists of particles with small penetrating power, apparently electrons with energies of the order of 10^8 e.v. Their production involves (*a*) scattering of electrons and mesons traveling at comparatively large angles with the horizon, (*b*) formation of δ-electrons, and (*c*) decay of resulting mesons. The no. of electrons resulting from *c* is calcd. to approx. 0.008 particle per min. per unit solid angle per sq. cm., agreeing in order of magnitude with the exptl. value.

M. J. Sienko

C° 1

Quenching of fluorescence by a light-absorbing medium. M. D. Galanin and I. M. Frank (P.N. Lebedev Phys. Inst. Acad. Sci. U.S.S.R., Moscow). *Zhur. Eksptl. i Teoret. Fiz.* 21, 114-20(1951); cf. preceding abstr.—Consideration, by classic electrodynamics, of a model consisting of an oscillating dipole of moment p, emitting a frequency ω, and placed in a homogeneous medium absorbing that frequency, gives in the case of $\alpha\lambda/2\pi \ll 1$, for the energy flux at a distance $R \sim \lambda/2\pi$, the expression $S_0 = (1/3)\omega^4 p^2 \alpha/c^3$, i.e. the same as for a transparent medium; at greater R, S decreases according to $S = S_0 e^{-\alpha R}$, and within the sphere $R \ll \lambda/2\pi$, an addnl. energy is absorbed in the amt. of $S_0(\lambda/2\pi\alpha)^3$, where α is an empirical const., greater than the sum of the radii of the interacting mols., and representing the min. R. Correspondingly, in the absorbing medium, the mean life τ of the excited state becomes $1/\tau = (1/\tau_0)[1 + (\alpha\lambda/2\pi)(\lambda/2\pi\alpha)^3]$, i.e. the relative variation of τ_0 is independent of its value, in contrast to ordinary collision quenching. In application to real fluorescent solns., p is a function of λ. On the assumption that the form of the function $p(\lambda)$ does not change as a result of absorption, the energy given up in an absorbing medium is $W = \int_{\lambda_1}^{\lambda_2} S(\lambda)[1 + (\alpha(\lambda)(\lambda/2\pi)^3/\alpha^3)]d\lambda = W_0 + \Delta W$, and the variation of τ should be of the form $1/\tau = 1/\tau_0[1 + (\Delta W/W_0)]$, where $\Delta W = \int_{\lambda_1}^{\lambda_2}(1/\alpha^3)S(\lambda)(\lambda/2\pi)^3\alpha(\lambda)d\lambda$ and $W_0 = \int_{\lambda_1}^{\lambda_2} S(\lambda)d\lambda$. The quenching is thus detd. by an overlap of the fluorescence and absorption spectra $S(\lambda)\alpha(\lambda)$ and the factor $(\lambda/2\pi)^3$, and this result is in approx. accord with expti. observations (cf. following abstr., Part II) with $\alpha \sim 3 \times 10^{-7}$ cm. Similar developments are given for a magnetic dipole and an elec. quadrupole. N. T.

FRANK, I. M., SHAPIRO, F. L., SHTRANIK, A. [illegible], M. V., [illegible], A. A., MURIN, I. D., and NEUPOKOYEV, B. A.

"A Study of Neutron Diffusion in Beryllium Graphite and Water by the Impulse Method," a paper presented at the Atoms for Peace Conference, Geneva, Switzerland, 1955

FRANK, I. M., FEYNBERG, Ye. L., GROSHEV, L. V., SHAPIRO, F. L., SHTRANICH, I. V., ROZINETS, O. I., LAZAREVA, L. Ye. and TOLSTOV, K. D.

"Investigation of the Parameters of Uranium-Graphite Systems by the Prism Method".

Report appearing in 1st Volume of "Session of the Academy of Sciences USSR On the Peaceful use of Atomic Energy, 1-5 July 1955", Publishing House of Sciences USSR, 1955.

SO: Sum 728, 28 Nov 1955.

FRANK, I.M.

USSR
4

1 RML

The multiplication of neutrons in uranium-graphite systems. I. V. Groshev, B. I. Feinberg, and I. M. Frank. *Sessiya Akad. Nauk S.S.S.R. po Mirnomu Ispol'zovaniyu Atomnoi Energii, Zasedaniya Otdel. Fiz.- Mat. Nauk* 1955, 3-18(English summary, 19-20); cf. following 3 abstracts. —The phys. aspect of neutron multiplication in a heterogeneous U-graphite system was discussed from the exptl. and theoretical standpoint. The expts. were carried out by the exponential method by using various concns. of U and for various temp. conditions. The values of the thermal neutron utilization const., θ, and of the multiplication const., k, were detd., and the effect of the air gap and of the water jacket around the slugs was studied. J. Rovtar Leach.

NU

Rmt (2)

Physics Inst. im P. N. Lebedev AS USSR Rm

FRANK, I. M.

#1

Measurement of temperature effects in uranium-graphite subcritical systems. B. P. Ad'yasevich, O. I. Kozlnets, K. D. Tolstov, I. M. Frank, F. L. Shapiro, and I. V. Shtranikh. *Sessiya Akad. Nauk S.S.S.R. po Mirnomu Ispol'zovaniyu Atomnoĭ Energii, Zasedaniya Otdel. Fiz.-Mat. Nauk* 1955, 132–54(English summary, 154–5).—The temp. effects on the multiplication const. $k_\infty = \nu\varepsilon\varphi\theta$ and also on all the factors thereof were investigated by two 120 × 120 × 260 cm. prisms, each in its own thermostat, heated to 300–450°. U-graphite (I) lattices were used with slug diams. of 32–7 mm. with various U conens. (*c*). A Ra-Be and a Po-Be neutron source were employed. The thermal utilization factor θ was measured by the Cd ratio method; a pos. temp. effect was found which increased with decreasing U conen. and was greater in the presence of cooling H_2O. This effect was already predicted by the elementary diffusion theory, but the theory furnished too high values in the absence and too low values in the presence of H_2O. This discrepancy was due to the fact that θ increased when the neutrons were cooled in H_2O upon entering the slug. The pos. effect on θ increased also if the cooling was extended over a layer of I adjacent to the slug. At identical U conens. the θ of a heterogeneous system can be increased over that of a homogeneous one by inhomogeneously heating the moderater. In order to evaluate correctly the temp. effect on the ε escape probability, φ, cold H_2O and H_2O at 80° were circulated alternately through the slugs, the temp. of the I being kept const. The variation of φ was obtained from exponential measurements of the buckling χ^2 and from measurements of the influence of heating on the epi-Cd neutron d. in the vicinity of the source. The temp. effect of the φ-integral is found to be $\delta\varphi/\varphi\,\delta t = (1.95 \pm 0.4) \times 10^{-4}$ per degree. The temp. effect on k_∞ was detd. by measuring χ^2 by the exponential method. The temp. changes of ν_i (no. of neutrons generated/no. of neutrons captured) were calcd. from the changes of φ and θ and from the temp. effect on k_∞. It was found that ν_i has a neg. temp. effect, which is roughly proportional to the variation of the mean energy of the thermal neutrons, caused by the heating of the system: $\delta\nu_i/\nu_i\,\delta\varepsilon = -(37 \pm 6)$ %/e.v. Werner Jacobson

FRANK, I.M.

USSR/Nuclear Physics - Fission of U by negative pi-mesons FD-2349

Card 1/2 Pub. 146 - 14/34

Author : Belovitskiy, G. Ye.; Romanova, T. A.; Sukhov, L. V.; and Frank, I. M.

Title : Fission of uranium nuclei under the action of slow negative pi-mesons and high-energy particles

Periodical : Zhur. eksp. i teor. fiz. 28, 729-732, Jun 1955

Abstract : In this work the authors investigate the fission of uranium nuclei by slow negative pi-mesons (G. Ye. Belovitskiy, et alii, Otchet FIAN*, April 1950, June 1950, March 1951), by fast neutrons, with energies up to 460 Mev, and by gamma-rays with energies up to 250 Mev (G. Ye. Belovitskiy et alii, ibid., Dec 1952). For the recording of the fission of uranium nuclei they used photoplates with emulsion layer 100 microns thick with uranyl acetate (T. A. Romanova and G. Ye. Belovitskiy, ibid., June 1951), which plates permitted the observation of protons with energies up to 30 Mev. The irradiation of the plates by slow negative pi-mesons and fast neutrons was carried out in the synchrocyclotron of the Institute of Nuclear Problems. Academy of Sciences USSR; the irradiation by gamma-rays was by the synchrotron of FIAN*. They note that the energy spectrum of neutrons from "overcharging" (peresaryadka) of

670-Mev protons on beryllium was measured by V. B. Flyagin. They present 5 photographs of indicated fission. They thank Prof. M. G. Meshcheryakov, G. P. Dzhelepov, and Ye. Grigor'yev for aid in experiments with negative pi-mesons and fast neutrons, and also thank Prof. V. I. Veksler and Yu. S. Ivanov for aid in experiments with gamma-rays of high energy. They state that a more detailed report on the results obtained will be published in this journal. They conclude that the distinguishing peculiarity of the process of fission of uranium nuclei at high energies of excitation is the significant probability of the emission of fast protons and alphaparticles; these particles bear only a comparatively small part of energy obtained by the uranium nucleus from the primary particle. Thirteen references.

Institution : Physical Institute imeni P. N. Lebedev, Acad. Sci. USSR (FIAN*)

Submitted : March 9, 1955

FRANK-I.M.

809-2mz

539.172

2385. FISSION OF URANIUM NUCLEI UNDER THE ACTION OF SLOW π^--MESONS, FAST NEUTRONS AND γ-RAYS OF ENERGY UP TO 250 MeV. G.E.Belovitskii, T.A.Romanova, L.V.Sukhov and I.M.Frank. 62

Zh. eksper. teor. Fiz., Vol. 29, No. 5(11), 537-50 (1955). In Russian.

Nucsci (3)

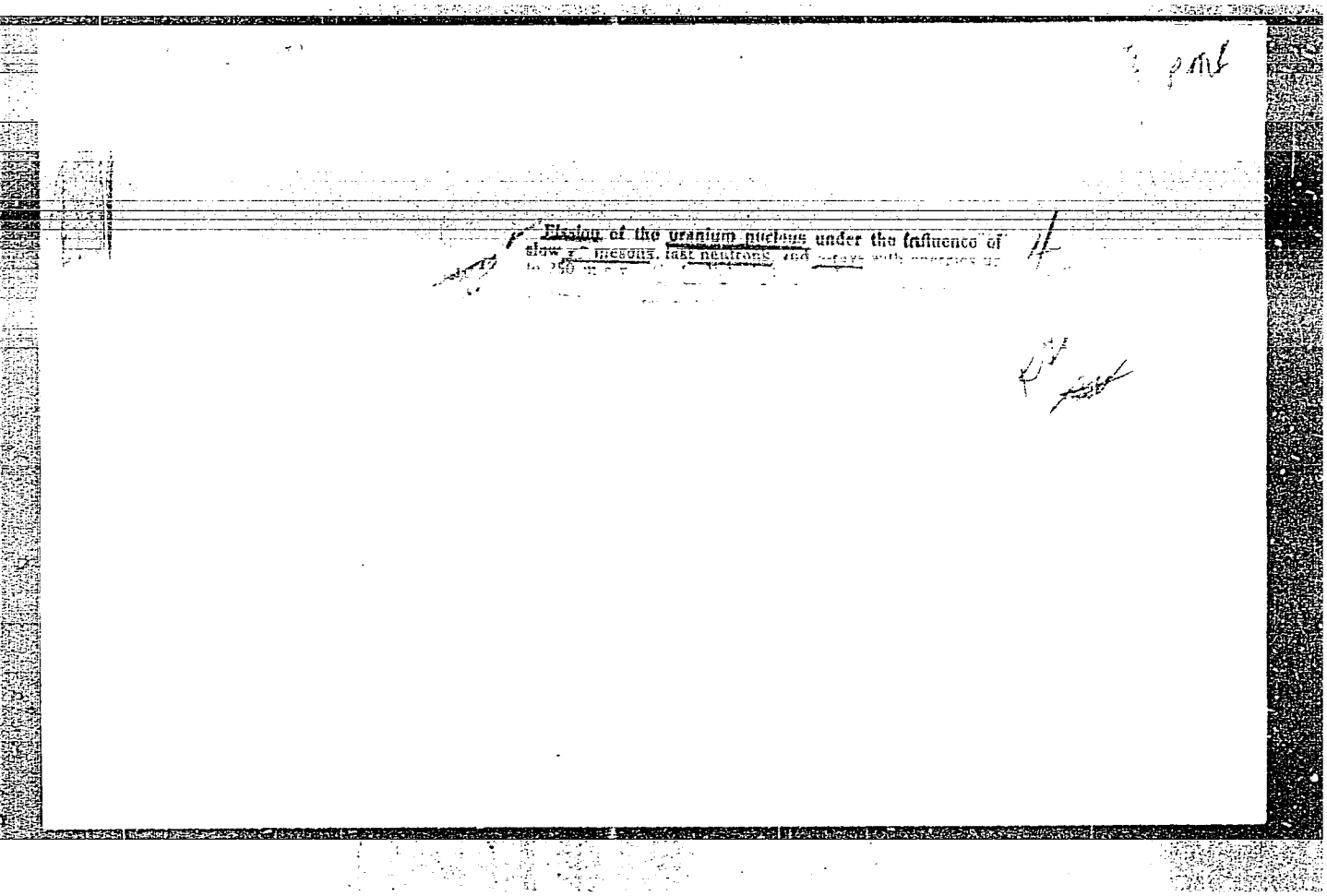
Events are studied in nuclear emulsions impregnated with uranium salt. The emulsions registered protons of energy less than 30 MeV. The plates were irradiated with π^--mesons and neutrons of maximum energies 180 and 460 MeV, and with γ-rays of maximum energies 30, 80 and 250 MeV. In 96 fissions by π^--mesons, 81 of the cases showed two fragments, 15 showed three. Probability of fission upon capture of a π^--meson is estimated to be about 0.5. Similarly, fissions brought about by high-energy neutrons and γ-rays were analysed. Fission produced by all three of these high-energy agents is sometimes accompanied by a fast proton or α-particle. These, however, carry away only a small part of the energy released and, since the fission fragments have about the same energy distribution as those produced by slow neutrons, it is surmised that most of the energy is taken up in neutron emission.

G.E.Brown

Translation D 419421 - p.27

FRANK, I. M.

"Experimental Data on the Anisotropic Distribution of Fission Fragments", a report presented at the Confernece on the Physics of Nuclear Fission, 19-21 January 1956, Atom Energ., No. 1, 1956.



Fission of the uranium nucleus under the influence of slow π^- mesons, fast neutrons, and [illegible]

NESMEYANOV, A.N.; TOPCHIYEV, A.V.; KURCHATOV, I.V.; SKOBEL'TSYN, D. .; KAPITSA, P.B.; IOFFE, A.F.; VINOGRADOV, A.P.; EHRENBURG, I.G.; TIKHONOV, N.S.; FADEYEV, A.A.; FRANK, I.M.; VEKSLER, V.I.; KORNEYCHUK, A.Ye.; POPOVA, N.V.; LEBEDEVA, Z.A.; VASILEVSKAYA, V.L.; PETROVSKIY, I.G.; ALEKSANDROV, A.D.; ARTSIMOVICH, L.A.; MESHCHERYAKOV, M.G.

Irene Joliet-Curie; obituary. Vest.AN SSSR 26 no.4:73-72 Ap '56. (Joliet-Curie, Irene, 1897-1956) (MLRA 9:7)

USSR/ Physics

Card 2/2 Pub. 118 - 5/7

Author : Frank, I. M.

Title : Flash duration in the Vavilov-Chernokov effect

Periodical : Usp. Fiz. nauk, 58/1, 111-150, Jan 1956

Abstract : A special type of luminescence of pure liquids and some solid bodies, called the Vavilov-Chernokov effect, is considered. A short duration of the light flash plays the main role in the Vavilov-Chernokov effect. Various devices (counters) for measuring the light flash duration are described. A theory on which the counters have been constructed is presented. In accordance with this theory the duration of a light flash can be expressed as

Institution : .....

Submitted : .....

Card 2/2 Pub. 118 - 5/7

Periodical : Usp. Fiz. nauk, 58/1, 111-150, Jan 1956

Abstract : follows: $\tau_o = \frac{1}{\Delta\nu}$, where the τ_o is the time of the duration, and the $\Delta\nu$ is a narrow frequency band within which the Vavilov-Chernokov effect is observed. Nineteen references: 1 Eng., 1 Fr., 4 USA, 13 USSR (1924-1955). Diagrams; graphs.

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SOV/58-59-4-7684

24.6600

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 4, p 60 (USSR)

AUTHORS: Balabanov, Ye.M., Barit, I.Ya., Katsaurov, L.N., Frank, I.M., Shtranikh, I.V.

TITLE: Yield and Effective Cross-Section Measurements of $D(t,n)He^4$ and $D(d,p)T$ Reactions for a Thick Heavy-Ice Target

PERIODICAL: V sb.: Yadern. reaktsii na legkikh yadrakh. Moscow, Atomizdat, 1957, pp 48 - 56

ABSTRACT: The authors measured the yield and effective cross sections of $D(t,n)He^4$ and $D(d,p)T$ reactions for heavy ice in the 50 - 200 Kev deuteron energy range. A D_2^+ or HT^+ beam from an ion-accelerating tube was sorted in accordance with the different masses of the particles by means of a magnet and a system of diaphragms. The reaction yield was determined from the number of alpha-particles or protons registered at an angle of 90° to the beam with the aid of proportional counters. For the $D(t,n)He^4$ reaction a maximum was observed for 160 Kev tritons; the magnitude of the cross section at the maximum was equal to 4.34 barn. The yield and cross-section measurements of the $D(d,p)T$ reactions were carried out by way of a check,

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SOV/58-59-4-7684

Yield and Effective Cross-Section Measurements of $D(t,n)He^4$ and D(d,p)T Reactions for a Thick Heavy-Ice Target

since reliable results for this reaction using a gas target have been published (Sanders et al, Phys. Rev., 1950, Vol 77, p 1754, McNeill, K.G., et al, Phys. Rev., 1951, Vol 81, p 602). The results of the measurements showed that for a significant part of the energy range the obtained cross sections were 10 - 20% less than those obtained using a gas target. The authors assume that this is due to an inaccuracy in the values utilized for the energy losses in D_2O, or to some other systematic errors .

V.I.Ch.

Card 2/2

FRANK, I.M.

Anisotropy in nuclear fission processes. Atom.energ.supplement no.1:58-73 '57. (MIRA 10:10)

(Nuclear fission)

BALABANOV, Ye.M.; BARIT, I.Ya.; KATSAUROV, L.N.; FRANK, I.M.; SHTRANIKH, I.V.

Measurement of the effective cross section of the $D(t,n)He^4$ reaction in the 40-730 Kev deuteron energy range. Atom. energ. suppl. no.5:57-70 '57. (MIRA 11:2)

(Nuclear reactions) (Deuterons)

53-3-2/6

FRANK, I.M.

AUTHORS: Skobel'tsyn, D.V., Frank, I.M.

TITLE: The Physics Institute imeni P.N. Lebedev AN USSR (Fizicheskiy institut imeni P.N. Lebedeva)

PERIODICAL: Uspekhi Fiz. Nauk, 1957, Vol. 63, Nr 3, pp. 503 - 525 (USSR)

ABSTRACT: This institute dates back to the oldest center of experimental physical research in Russia. In 1725 the "Physical Cabinet" was founded together with the Academy of Science; in 1912 it was reorganized as physical laboratory. In 1921 this laboratory was transformed into the physical department of the physical-mathematical institute of the AN. In 1934 the institute, together with the AN, moved from Leningrad to Moscow, and in the same year the physical institute AN (FIAN) imeni P.N. Lebedev was established. The first director of the institute (1934-1951) was S.I. Vavilov, and after his death D.V. Skobel'tsyn. Special mention is made of Vavilov's works on the luminescence of uranyl salts which led to the discovery of the Vavilov-Cherenkov effect. The research work carried out and the collaborators of the various laboratories of this institute are mentioned. During World War II the institute was at Kazan, and by its activities assisted the armament industry.

Card 1/4

The Physics Institute imeni P.N. Lebedev AN USSR

The institute has now seven times the number of collaborators it had in 1945. At present 20 doctors and 100 candidates of sciences are working at the institute. The library at present contains 200 000 volumes (books and periodicals).

General survey of themes and of some of the results achieved by the institute: At first the success achieved by V.I. Veksler in connection with the construction of particle accelerators is mentioned. The successes achieved in the physics of elementary particles were prepared by the study of cosmic radiation. In recent times successful investigations were carried out by means of the photo-emulsion method. Also the theoretical department of the institute deals with the physics of elementary particles and of nuclear interactions. Well-known works are those by I.Ye. Tamm on mesonic interaction. Much is said about the work carried out by the institute in connection with the Vavilov-Cherenkov effect. The work and the themes dealt with by individual laboratories of the institute are then discussed.

Theoretical physics: Elementary particles, non-local theory, renormalizability and dispersion relations, multiple production of particles, cosmic rays, neutron physics, high-energy processes, solid bodies, low temperatures.

The Physics Institute imeni P.N. Lebedev AN USSR

53-3-2/6

Nuclear Physics: Work concerning nuclear physics and cosmic rays has been developing since 1933, and supervision of this work was soon taken by D.V. Skobel'tsyn. During the war work on cosmic radiation was stopped until 1944, and already in 1944 the first expedition was sent to Pamir, and in 1947 the first high mountain station was established. The next report deals with new accelerators. Apart from theoretical work also theoretical research work was carried out on a large scale under supervision of M.A. Markov in the two following directions: Investigation of phenomena that are important for the research of atomic structure by the method of photonuclear reactions. Investigation of the properties of the meson field and of meson-producing processes by photonuclear interaction.

Further chapters deal with work carried out in the field of radiophysics, luminescence and optics, semiconductors and dielectrics. At present the effect produced by neutrons and fast electrons upon germanium is being studied. In this connection also some rules concerning the transformation of the energy of ß-radiation into electric energy were set up. There are 67 references, all of which are Slavic.

Card 3/4

The Physics Institute imeni P.N. Lebedev AN USSR 53-3-2/6

AVAILABLE: Library of Congress

Card 4/4

DENISOV, F.P.,red.; LAZAREVA, L.Ye.,red.; LEYKIN, Ye.M.,red.; ROZHANSKIY, I.D.,red.; FRANK, I.M.,red.; SHAPIRO, I.S.,red.; SHAPIRO, F.L.,red.; POLEMOVA, T.P.,tekhn. red.

[Low and intermediate energy nuclear reactions; transactions of the conference] IAdernye reaktsii pri malykh i srednikh energiiakh; trudy konferentsii. Moskva, Izd-vo Akad. nauk SSSR, 1958. 614 p. (MIRA 11:12)

1. Vsesoyuznaya konferentsiya po yadernym reaktsiyam pri malykh i srednikh energiyakh. Moscow, 1957.
(Nuclear reactions)

FRANK, I. M.

"The Application of Atomic Energy for Peaceful Purposes"

Lecture to be delivered by Soviet Scientists at the Brussels Exhibition, August 1958. The delivered lectures will be available in English, French, Flemish and German as individual brochures.
(Priroda, 1958, No. 8, p. 116)

24(5) PHASE I BOOK EXPLOITATION SOV/2121

Frank, Il'ya Mikhaylovich, Corresponding Member, USSR Academy of Sciences, Laureate of the Nobel Prize

Izlucheniye Vavilova-Cherenkova; lektsiya, prochitannaya na Vsemirnoy vystavke v Bryussele... (Vavilov-Cherenkov Radiation; a Lecture Delivered at the Brussels' World Fair on August 13, 1958) Moscow, Izd-vo "Znaniy", 1959. 30 p. (Series: Vsesoyuznoye obshchestvo po rasprostraneniyu politicheskikh i nauchnykh znaniy. Seriya IX, 1959, no. 8) 36,000 copies printed.

Sponsoring Agency: Vsesoyuznoye obshchestvo po rasprostraneniyu politicheskikh i nauchnykh znaniy.

Ed.: I.B. Faynboym; Tech. Ed.: L.Ye. Atroshchenko.

PURPOSE: The booklet is intended for the general reader interested in physics.

Card 1/2

Vavilov-Cherenkov Radiation (Cont.) SOV/2121

COVERAGE: This booklet contains a lecture on luminescence phenomenon delivered by the author at the Brussels' World Fair on August 13, 1958. The author describes the Vavilov-Cherenkov effect and the properties of fast particles at some length. Brief biographies of Soviet scientists who have been awarded Nobel prizes are included in the booklet. No references are given.

TABLE OF CONTENTS:

On Light and Matter 3

Luminescence 4

Vavilov-Cherenkov Effect 6

Nature of the Phenomenon 9

Vavilov-Cherenkov Radiation and the Properties of Fast Particles 12

Nobel Prizes Awarded to Soviet Scientists (information) 20

AVAILABLE: Library of Congress

Card 2/2 TM/ad
8-21-59

FRANK, I. M.

21(0),24(0) PHASE I BOOK EXPLOITATIO' SOV/32

Akademiya nauk SSSR. Fizicheskiy institut

Issledovaniya po eksperimental'noy i teoreticheskoy fizike; [sbornik] (Studies on Experimental and Theoretical Physics; Collection of Articles) Moscow, Izd-vo AN SSSR, 1959. 304 p. Errata slip inserted. 2,300 copies printed.

Ed.: I. L. Fabelinskiy, Doctor of Physical and Mathematical Sciences; Eds. of Publishing House: A. L. Chernyak and V. G. Berkgaut; Tech. Ed.: Yu. V. Rylina; Commission for Publishing the Collection in Memory of Grigoriya Samuilovich Landsberg: I. Ye. Tamm (Chairman), Academician; M. A. Leontovich, Academician; P. A. Bazhulin, Doctor of Physical and Mathematical Sciences; S. L. Mandel'shtam, Doctor of Physical and Mathematical Sciences; I. L. Fabelinskiy, Doctor of Physical and Mathematical Sciences; F. S. Landsberg-Baryshanskaya, Candidate of Physical and Mathematical Sciences; and G. P. Motulevich (Secretary), Candidate of Physical and Mathematical Sciences.

PURPOSE: This book is intended for physicists and researchers engaged in the study of electromagnetic radiations and their role in investigating the structure and composition of materials.

COVERAGE: The collection contains 30 articles which review investigations in spectroscopy, sonics, molecular optics, semiconductor physics, nuclear physics, and other branches of physics. The introductory chapter gives a biographical profile of G. S. Landsberg, Professor and Head of the Department of Optics of the Division of Physical Technology at Moscow University, and reviews his work in Rayleigh scattering, combat gases, spectral analysis of metals, etc. No personalities are mentioned. References accompany each article.

Neporent, B. S. Kinetics of the Action of Light Gases on the Intensity of Absorption Spectra of Vapors of Aromatic Compounds 149

Obreimov, I. V. and Ye. S. Trekhov. The Resistance of Mica to Rupture Along the Cleavage Plane 159

Rytov, S. M. The Correlation Theory of Rayleigh Light Scattering 175

Sobel'man, I. I. The Quantum Mechanics Theory of the Intensity of Combined-Scattering Lines 192

Sushchinskiy, M. M. Dependency of the Width of Combined-Scattering Lines of the Anisotropy of a Derived Polarizability Tensor 211

Tamm, I. Ye. Present State of the Theory of Weak Interactions of Elementary Particles 218

Tumerman, L. A. and B. A. Chayanov. The Illumination of Dielectrics in High Voltage a-c Electric Fields 231

Ukholin, S. A., and M. Z. Pronina. Investigation of Combined Light-Scattering Spectra in H_2O_2-H_2O and H_2O_2-Dioxane Solutions 244

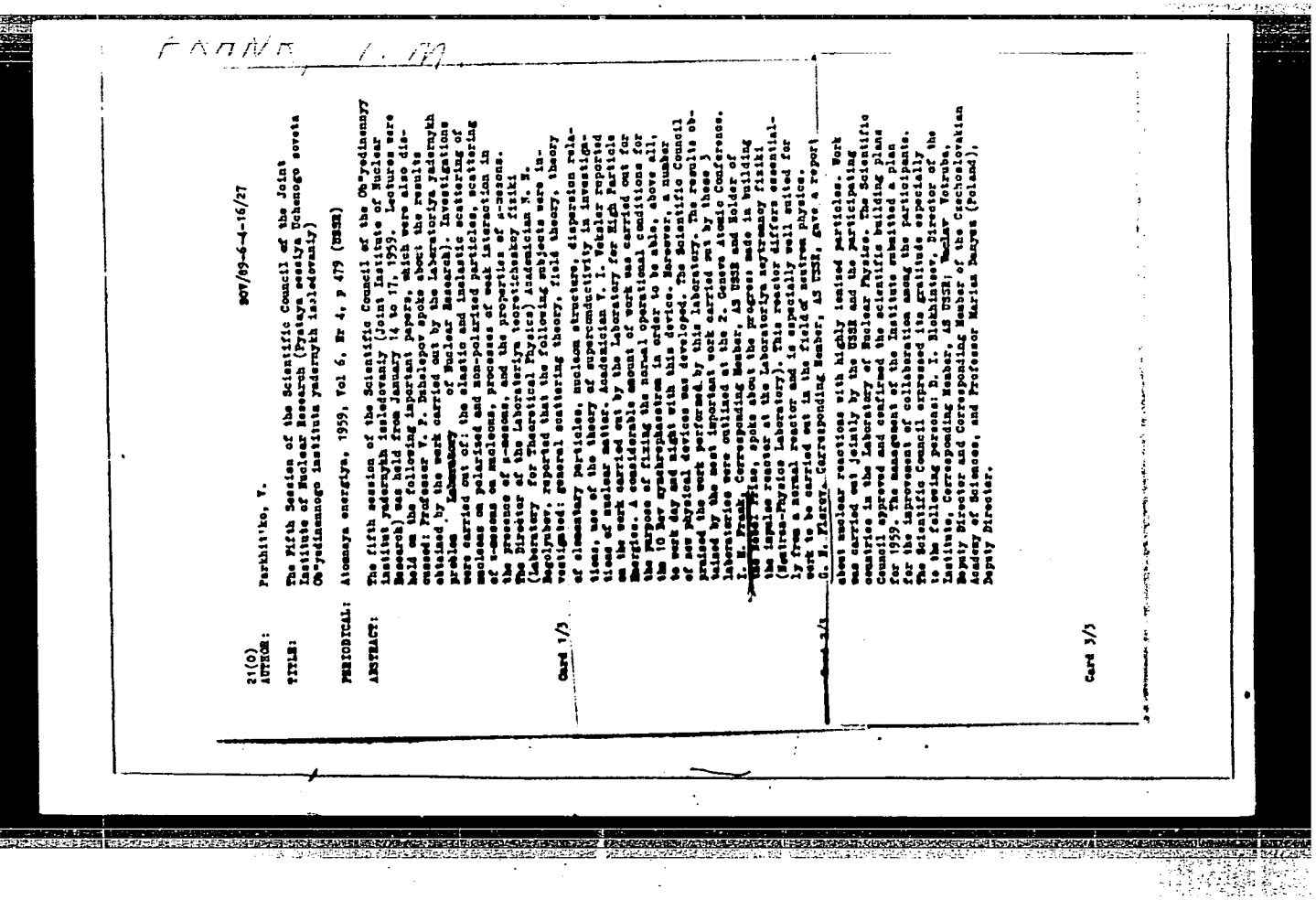
Fabelinskiy, I. L. The Thin Structure of Lines of Rayleigh Light-Scattering in Gases 254

Frank, I. M. The Role of the Group Speed of Light in Irradiation in a Refractive Medium 261

Frish, S. E., and I. P. Bogdanova. Excitation of Spectral Lines in the Negative Illumination of a Gas Discharge 275

Frishberg, A. A., and V. V. Madler. The Possibility of Increasing the Sensitivity of the Spectral Determination of Some Elements 287

Shpol'skiy, E. V. The Interpretation of Spectra of Aromatic Hydrocarbons in Frozen Crystalline Solutions 296



SOV/89-6-4-16/27

21(0)
AUTHOR: Parkhitko, V.

TITLE: The Fifth Session of the Scientific Council of the Joint Institute of Nuclear Research (Pyataya sessiya Uchenogo soveta Ob"yedinennogo instituta yadernykh issledovaniy)

PERIODICAL: Atomnaya energiya, 1959, Vol 6, Nr 4, p 479 (USSR)

ABSTRACT: The fifth session of the Scientific Council of the Ob"yedinennyy Institut yadernykh issledovaniy (Joint Institute of Nuclear Research) was held from January 14 to 17, 1959. Lectures were held on the following important papers, which were also discussed: Professor V. P. Dzhelepov spoke about the results obtained by the work carried out by the Laboratory of Nuclear Problems (Laboratoriya yadernykh problem). Laboratory of Nuclear Research): Investigations were carried out of: the elastic and inelastic scattering of mesons on polarized and non-polarized particles, scattering mesons on polarized and non-polarized particles, scattering of π-mesons on nucleons, processes of weak interaction in the presence of π-mesons, and the properties of π-mesons. The Director of the Laboratoriya teoreticheskoy fiziki (Laboratory for Theoretical Physics) Academician N. N. Bogolyubov, reported that the following subjects were investigated: general scattering theory, field theory, theory

Card 1/3

of elementary particles, nucleon structure, dispersion relations, use of the theory of superconductivity in investigations of nuclear matter. Academician V. I. Veksler reported on the work carried out by the Laboratory for High Particle Energies. A considerable amount of work was carried out for the purpose of fixing the normal operational conditions for the 10 Bev synchrophasotron in order to be able, above all, to work day and night with this device. However, a number of new physical devices was developed. The Scientific Council examined the work performed by this laboratory. The results obtained by the most important work carried out by these 3 laboratories were outlined at the 2. Geneva Atomic Conference. I. M. Frank, Corresponding Member, AS USSR and Holder of the Nobel Prize, spoke about the progress made in building the impulse reactor at the Laboratoriya neytronnoy fiziki (Neutron-Physics Laboratory). This reactor differs essentially from a normal reactor and is especially well suited for work to be carried out in the field of neutron physics.

Card 2/3

G. N. Flerov, Corresponding Member, AS USSR, gave a report about nuclear reactions with highly ionized particles. Work was carried out jointly by the USSR and the participating countries in the Laboratory of Nuclear Physics. The Scientific Council approved and confirmed the scientific building plans for 1959. The management of the Institute submitted a plan for the improvement of collaboration among the participants. The Scientific Council expressed its gratitude especially to the following persons: D. I. Blokhintsev, Director of the Institute, Corresponding Member, AS USSR; M. Nagy, Member of the Hungarian Academy of Sciences, Deputy Director and Corresponding Member of the Czechoslovakian Academy of Sciences, and Professor Maria Danysz (Poland), Deputy Director.

Card 3/3

24(4)

AUTHOR: Frank, I. M.

SOV/56-36-3-25/71

TITLE: On the Rôle of the Group Velocity of Light in the Case of Radiation in a Refractive Medium (O roli gruppovoy skorosti sveta pri izluchenii v prelomlyayushchey srede)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 3, pp 823-831 (USSR)

ABSTRACT: In the present paper the author investigates the part played by the group velocity of light in a radiation, the source of which moves uniformly in a refractive isotropic medium, it being assumed that the medium is transmissive with respect to the emitted light. The radiation of a moving light source depends essentially on the ratio between the velocity of the emitter and the phase velocity of the emitted frequency. For particles which generate a time-constant electromagnetic field (e.g. electric charges or constant magnetic dipoles), i.e. at an eigenfrequency that is equal to zero, the Cherenkov effect occurs (which is also called Vavilov-Cherenkov effect in Russian publications), if the velocity of motion v is equal to or begins to exceed the phase velocity of light. In the case of

this connection between the direction of light radiation and the emitted frequency ω_0 it holds that $v \cos\theta/(c/n(\omega_0)) = 1$, $n(\omega_0) = c/v \cos\theta$, $u = c/n(\omega_0)$;

the emitted frequency, like Cherenkov radiation, is subjected to a Doppler effect for which $v/(c/n(\omega_0)) = \beta n(\omega_0)$ holds.

Basing on these assumptions the author first investigates the Cherenkov effect and the conditions for the occurrence of complex radiation. In the last part of the paper the connection between the velocity of the motion of the emitter and the group velocity of light is investigated, which leads the author to the conclusion that the emitter is not able to catch up with the light signal emitted by it in the direction of its motion. There are 3 figures and 4 Soviet references.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR)

SUBMITTED: August 16, 1958

24 (4)

AUTHOR: Frank, I. M. SOV/53-68-3-4/11

TITLE: The Optics of Light Sources Moving in Refracting Media (Optika istochnikov sveta, dvizhushchikhsya v prelomlyayushchikh sredakh)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 68, Nr 3, pp 397-415 (USSR)

ABSTRACT: This is a reproduction of a lecture delivered on the occasion of the awarding of the Nobel Prize. It consists of five parts. In part 1 the particular features of the radiation discovered by Cherenkov and Vavilov in a refracting medium are discussed together with the conditions for the occurrence of this radiation and its properties. In this connection reference is made to L. I. Mandel'shtam and V. L. Ginzburg. In part 2 the author discusses as a characteristic example the so-called transition radiation; it occurs e.g. if a uniformly moving charged particle exceeds the boundary of two media with different refraction indices. The intensity of this radiation is proportional to the kinetic energy of the particle at low velocities, and at relativistic velocities it grows like the logarithm of the total energy. Two particularities of this radiation within the range of ultrarelativistic velocities are discussed and the results obtained by investigations carried out by A. Ye. Chudakov and

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V. Ye. Pafomov are mentioned. Part 3 deals with the radiation spectrum and with the quantum-theoretical interpretation of the Cherenkov effect (according to Ginzburg). A number of the most important equations is given. Again, a particle moving with constant velocity in a refracting medium is investigated. If the momentum $n\hbar\omega/c$ of the photon is small compared to the momentum of the radiation source, the theorem of the conservation of momentum may be written down as $\frac{n\hbar\omega}{c}\cos\theta = \frac{\Delta E}{v}$, where ΔE denotes the kinetic energy of the radiation source. $\Delta E = \hbar\omega \pm \hbar\omega_0$ (ω_0 is the eigenfrequency in the laboratory system). Thus, $\frac{n\omega}{c}\cos\theta = \frac{\omega \pm \omega_0}{v}$ is obtained. In the following, 3 cases are discussed: if $\frac{n\omega}{c}\cos\theta = 1$, < 1 and > 1. Finally a classical discussion of the Doppler effect is given, and the possibility of a velocity greater than that of light in a medium is discussed. It was found that an arbitrary system capable of interacting with radiation slows down at a velocity greater than that of light and emits light. In part 4 the author discusses radiation thresholds and investigates the conditions for the occurrence of Cherenkov

radiation and of the Doppler effect for velocities greater than that of light. For this, the condition $\frac{vn(\omega)}{c} > 1$ is, first of all, given, which says that v must be greater than the phase velocity of light. L. I. Mandel'shtam pointed out that the complex Doppler effect is connected with the amount of the group velocity W of light. On the basis of a diagram (Fig 1), which represents the frequency dependence of the wave vector $k(\omega) = \frac{\omega n(\omega)}{c}$, these conditions are discussed and a number of formulas is derived. Figure 2 shows some possible cases of connections existing between $\vec{u}$, $\vec{v}$, $\vec{w}$ and θ, which are discussed. Part 5 finally deals with Cherenkov radiation in optically anisotropic media. In this connection the case is investigated in which the radiation source moves in a crystal, in which the refraction index depends not only on light frequency but also on the angle and on polarization. The influence exercised by the latter is discussed in detail, and a number of special cases is further discussed on the basis of schematical drawings. Also the Doppler effect is dealt with, and attention is drawn

to the most important investigations carried out by K. A. Barsukov and A. A. Kolomenskiy. There are 6 figures and 18 references, 16 of which are Soviet.

PHASE I BOOK EXPLOITATION SOV/4393

Cherenkov, Pavel Alekseyevich, Professor, Igor' Yevgen'yevich Tamm, Academician, and Il'ya Mikhaylovich Frank, Corresponding Member, Academy of Sciences USSR

Nobelevskiye lektsii (Nobel Prize Papers) Moscow, Fizmatgiz, 1960. 73 p. 7,000 copies printed.

Ed.: T. V. Mikhalkevich; Tech. Ed.: Ye. A. Yermakova.

PURPOSE: This pamphlet is intended for physicists and researchers engaged in the application of the Cherenkov radiation principle in experimental physics.

COVERAGE: The pamphlet contains lectures by Professor P. A. Cherenkov, Academician I. Ye. Tamm, and Corresponding Member of the USSR Academy of Sciences I. M. Frank given in Stockholm on December 11, 1958 when receiving the Nobel Prize in physics. The supplementary article relates the history of the discovery of the Cherenkov radiation and presents biographical data on the three Nobel Prize re-

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cipients. Photographs of the prize winners are included in the booklet. The complete text of the speeches and of the article were previously published in Uspekhi fizicheskikh nauk, v. 67, no. 1, and v. 68, no. 3. The articles are accompanied by bibliographies listing Soviet and other technical literature.

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Frank, I. M. Optics of Light Sources Moving in Refractive Media

35

Supplement. Bolotovskiy, B. M. Soviet Scientists, Winners of the 1958 Nobel Prize in Physics

64

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B009/B057

AUTHOR: Frank, I. M.

TITLE: Optics of Light Sources Moving in Refractive Media

PERIODICAL: Fizikai Szemle, 1960, Vol. 10, No. 10, pp. 298-304

TEXT: This is an abridged text of a lecture delivered at the conferment of the Nobel Prize upon the author in Stockholm on December 11, 1958. The full-length text was published in Uspekhi Fizicheskikh Nauk, Vol. 68 (1959), pp. 397-415. 1) Characteristics of light in a medium: In vacuum, the velocity of light is always constant and higher than the velocity of the light source. In a refractive medium, the ratio of the velocity of the radiant to the velocity of wave propagation depends very much on the velocity of light in the medium and on its changes. As a result, not only the characteristics of radiation but sometimes also its appearance depends on the features of light propagation in the medium. In this paper, the simplest case of radiation in refractive media is considered, where the translational motion of the system may be supposed to be uniform and rectilinear. 2) Transition radiation: The theory of transition radiation

was developed by V. L. Ginzburg and the author of this paper more than 10 years ago, but was not examined experimentally. Most promising results have been recently reached by A.Ye. Chudakov but have not been published as yet. V. Ye. Pafomov pointed out that for very small thicknesses of the radiator, transition radiation must be considered as a component in the observation of the Cherenkov radiation. 3) Spectrum and quantum-mechanical interpretation: The quantum-mechanical theory of transition radiation was first developed by Ginzburg who demonstrated that the classical formula of the cosine of the angle at which the radiation takes place may be supposed to be exact with a very small correction. In vacuum, motion at a velocity exceeding that of light is impossible. In a medium, it appears possible, but nature does not entirely cancel that prohibition. An arbitrary system, capable of radiation interactions, will - at velocities exceeding that of light - be slowed down by emission of light. 4) Thresholds of radiation: The spectrum of radiation is determined by the velocity of the system, its fundamental frequency, and the phase velocity of light valid for the system. From formulas deduced for the Cherenkov phenomenon and the Doppler effect at velocities exceeding that of light, it follows that these radiations can develop only if the

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velocity of motion of the system exceeds the phase velocity of light. This statement which holds for isotropic media determines the threshold of generation of radiation. In a refractive medium, energy transfer takes place not at phase but at group velocity. If the conditions of its development are satisfied, radiation develops and draws energy from the radiant. When the velocity of light reaches the threshold, radiation ceases and so does the discharge of energy. This will be the case when the group velocity of light equals the velocity of motion of the system. The role of the group velocity of light will manifest itself particularly clearly in an anisotropic medium where it includes a certain angle with the phase velocity. (Section 5 of the lecture dealt with radiation in optically anisotropic media and is excluded from this text). L. I. Mandel'shtam is mentioned. There are 12 references: 11 Soviet and 1 US.

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AUTHOR: Frank, I. M.

TITLE: Critical Velocity of Light Emission in Optically Anisotropic Media

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 6, pp. 1751-1757

TEXT: The author deals with the investigation of the emission of a light source of arbitrary natural frequency, moving uniformly in an optically anisotropic transparent medium. In an optically isotropic medium a Vavilov-Cherenkov radiation of the frequency ω occurs, if the velocity of motion v of the emitting charge attains the phase velocity of light $u(\omega) = c/n(\omega)$. In the expression for the wave vector $k(\omega)$ only the phase velocity occurs; it is, however, to be assumed that in optically anisotropic medium the group velocity plays a similar part. First, the peculiarities occurring in an anisotropic medium are discussed, which are based mainly upon the fact that the phase velocity depends both on the polarization of the waves and on the direction of $\vec{k}(\omega)$. On

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the basis of the simple case of a monochromatic wave of given polarization it is shown that for the critical velocity $\vec{u}'(\omega)$ occurring in the case of an anisotropic medium, $\vec{v} = \vec{u}'$ holds. This second phase velocity u' is described by the author as "radiation velocity along the beam". Fig. 1 illustrates the foregoing. It holds generally that $\vec{k}'(\omega) = \frac{\omega}{u'^2}\vec{u}' = \frac{\omega \pm \omega_0}{v^2}\vec{v}$; if $\omega_0 = 0$, $\vec{v} = \vec{u}'$ is thus satisfied. This equation is the condition holding in an anisotropic medium for the occurrence of a radiation of the frequency ω. In the case represented in Fig. 1, the surface of the wave vectors is an ellipsoid, and therefore the "extraordinary" beam in a uniaxial crystal is concerned. An analogous investigation is carried out for the ordinary beam ($\vec{k}$ - surface: sphere); v = u = u'. In the following, the peculiarities occurring in a biaxial crystal are discussed. Fig. 2 shows k' as a function of ω for a given polarization. If w is the group velocity of a beam of the frequency ω, which runs the direction $\vec{v}$, the condition holding for the occurrence of a radiation or of new components of it is $\vec{v} = \vec{w}(\omega_{gr})$, where ω_{gr} is the frequency

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primarily occurring in the spectrum, for which the condition given above for $\vec{k}'(\omega)$ is satisfied. Finally, the case $\omega < \omega_0$ is investigated. All results obtained are analogous to those obtained for an isotropic medium (Refs. 5, 6). They hold for the case in which the direction of motion coincides with the direction of the beam. V. L. Ginzburg and V. Ye. Pafomov are mentioned in this paper. There are 2 figures and 6 Soviet references.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: December 21, 1959

FRANK, I. M., SHALIKO, F. L., KAZVITSKIY, Y. S., BLOKHIN, B. I.,

BLOKHIN, G. P., L'UMPFIMA, Y. A., BONDARENKO, I. I., DEVYACHIN, P. T., ZAMOLSKIY, A. S., ZINOVIYEV, V. P., KAZACHKOVSKIY, O. D., KRAZNOYAROV, N. V., LEYPUNSKIYA, A. I., MALIKOV, V. A., NAZAROV, P. M., NIKOLAYEV, S. K., SLAVISKIY, Y. Y., UKRAINTSEV, F. I.

"A Pulse Fast reactor."

report submitted for the IAEA seminar on the Physics of Fast and Intermediate Reactors, Vienna, 3-11 Aug 1961.

Acad Sci. USSR Moscow

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B102/B214

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AUTHORS: Blokhin, G. Ye., Blokhintsev, D. I., Blyumkina, Yu. A., Bondarenko, I. I. Deryagin, B. N., Zaymovskiy, A. S., Zinov'yev, V. P., Kazachkovskiy, O. D., Kim Khen Bon, Krasnoyarov, N. V., Leypunskiy, A. I., Malykh, V. A. Nazarov, P. M., Nikolayev, S. K., Stavisskiy, V. Ya., Ukraintsev, F. I., Frank, I. M., Shapiro, F. L., Yazvitskiy, Yu. S.

TITLE: A pulsed fast reactor

PERIODICAL: Atomnaya energiya, v. 10, no. 5, 1961, 437-446

TEXT: The present paper gives a description of the pulsed fast reactor of the Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research) which became critical in June, 1960. This reactor, called ИБР (IBR) reactor, serves as pulsed fast neutron source (mean power ≈1 kw) for physical investigations, particularly for time-of-flight experiments. Its most distinguishing feature is the very small contribution ($\sim 10^{-4}$) of the delayed neutrons in its normal operation; it is about

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one hundredth of that of the usual steady uranium reactor. The pulses appear because whenever the reactor becomes overcritical a burst of prompt neutrons results. The half width of these pulses is 36 μsec. The frequency with which the pulses are repeated can be varied between 8 and 80 pulses/sec. Fig. 2 shows the construction of this reactor. The periodic change in the reactivity is brought about by the displacement of the two U^{235} blocks placed in two disks that can be rotated. The main block is pressed in the form of a disk, 1100 mm in diameter, and can be rotated with a peripheral velocity of 276 m/sec (at 6000 rpm) during which it passes through the core center. The reactivity change obtainable from the motion of the main block is 7.4 %, that obtainable from the motion of the auxiliary block is 0.4 %. The stationary part of the core consists of plutonium lumps in steel jackets. The reactor is started by a rough regulator, in this case a movable part of the reflector. It gives a reactivity change at the rate of $13 \cdot 10^{-5} - 1.3 \cdot 10^{-5}$ sec^{-1}. The manually operated rod is also a part of the reflector. Two plutonium rods in electromagnetic suspension serve as scram. They can be separated from the core with an acceleration of 20 g. Their separation causes a reactivity

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decrease of 2-1.1 $; the rough regulator allows a reactivity change of 2.4 $, the manual regulator 0.1 $, and the automatic regulator 0.036 $. The reactor possesses also a reactivity booster for the production of one intensive pulse. The control and shield system is an automatically functioning electronic arrangement with BF_3 counters and ionization chambers. The whole reactor is placed in a room of size 10·10·7 m whose concrete walls allow complete protection from radiation. The most important experimental arrangement consists of a 1000 m long neutron conductor, a metal tube, 400 mm in diameter in the first part and 800 mm in the second part in which a pressure of 0.1 mm Hg is maintained. This conductor connects a chain of socalled "intermediate pavilions" (at distances of 70, 250, 500, 750, and 1000 m from the reactor) in which experiments can be carried out. There is also an additional neutron conductor of 100 m length. The reactor chamber is joined to an experimental chamber in which four neutron beams of up to 800 mm diameter are available. There us such an experimental chamber also above the reactor chamber. Various experiments were carried out with the reactor and they are described in the present paper. These are experiments with stand

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assemblies and slowly moving main block for the determination of the most important parameters of the reactor; experiments with a core assembly (unmoved), experiments with rotating (5000 rpm) main block and a Ra-α-Be source in the core for the investigation of the effect of the multiplication factor, etc. The most important results are represented graphically. For example, Fig. 8 shows the dependence of the half width Θ of a pulse on the reactivity; the dashed line holds for the quasistationary case, the dot-dash line for the case of $\Theta = K(\tau/\alpha)^{1/3} v^{-2/3}$, where v is the velocity of motion of the (rotating) main block; in the quasistationary case $\Theta = 2\sqrt{\varepsilon_m/\alpha v^2}$, where ε_m is the reactivity at the maximal multiplication factor; $\varepsilon = \varepsilon_m - \alpha x^2$, where x is the displacement of the main block. The reactor has been actually used for the measurement of the total, scattering, capture, and fission cross sections by the time-of-flight method. Further experiments will be carried out with a view to obtaining increase of power and decrease of the pulse duration. There are 15 figures and 3 references: 2 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: J. Orndorf, Nucl. Sci. and Engng, 2, No. 4, 450 (1957).

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LEVSHIN, V.L.; TEREMIN, A.N.; FRANK, I.M.

Progress of S.I.Vavilov's work in the field of physics.
Usp.fiz.nauk 75 no.2:215-225 O '61. (MIRA 14:10)
(Vavilov, Sergei Ivanovich, 1891-) (Physics)

FRANK, I.M.

Transient radiation and the Vavilov-Cherenkov effect. Usp.fiz.nauk 75 no.2:231-240 O '61. (MIRA 14:10)
(Cherenkov radiation)

GRIGOROV, Nqum Leonidovich; KONDRAT'YEVA, Marina Aleksandrovna; RAPOPORT, Il'ya Davidovich; FRANK, I.M., red.; GRIGOROVA, V.A., red.; PLAKSHE, L.Yu., tekhn. red.

[Cosmic rays]. Kosmicheskie luchi. Moskva, Fizmatgiz. 1962. 83 p. (Praktikum po iadernoi fiziki, no.2). (MIRA 16:4)

1. Chlen-korrespondent AN SSSR (for Frank).
(Cosmic rays)

ESTULIN, Isay Veniaminovich; ZHABOTINSKIY, Ye.Ye., red.; FRANK, I.M., red.; MURASHOVA, N.Ya., tekhn. red.

[Radioactive radiations]. Radiactivnye izlucheniia. Moskva, Fizmatgiz, 1962. 260 p. (Praktikum po iadernoi fizike, no.1). (MIRA 16:4)

1. Chlen-korrespondent AN SSSR (for Frank).
(Radioactivity)

FRANK, I.M., otv. red.; DAVYDOV, A.S., red.; LAZAREVA, L.Ye., red.
NEMIROVSKIY, P.E., red.; CHUYEV, V.I., red.; POLYAKOVA, T.V.,
tekhn. red.

[Transactions of the Second All-Union Conference on Nuclear Reactions at Low and Medium Energies] Trudy Vtoroy Vsesoyuznoy konferentsii po iadernym reaktsiiam pri malykh i srednikh energiiakh, Moscow. 1960. Moskva, Izd-vo Akad. nauk SSSR, 1962. 658 p. (MIRA 16:2)

1. Vsesoyuznaya konferentsiya po yadernym reaktsiyam pri malykh i srednikh energiyakh, 2d, Moscow, 1960.
(Nuclear physics—Congresses)

S/903/62/000/000/014/044
B102/B234

AUTHORS: Benetskiy, B. A., Betin, Yu. P., Bukarev, V. A., Frank, I. M.

TITLE: (n,γ)-correlation in inelastic scattering of 14-Mev neutrons from C^{12} nuclei

SOURCE: Yadernyye reaktsii pri malykh i srednikh energiyakh; trudy Vtoroy Vsesoyuznoy konferentsii, iyul' 1960.g. Ed. by A. S. Davydov and others. Moscow, Izd-vo AN SSSR, 1962, 178-179

TEXT: 14-Mev neutrons from a $T^3(d,n)He^4$ source were scattered from a toroidal carbon scatterer; the γ-rays were recorded by a NaI(Tl) scintillation detector with FEU-29 (FEU-29) photomultiplier, the neutrons by a stack of plates of an organic scintillator separated by plexiglas and connected with an FEU-24 (FEU-24) multiplier. Also the recoil protons with 7 Mev $\leq E_p \leq$ 14 Mev were recorded. The pulse-height resolution of the γ-detector was 10% for Tn^{65} 1.12-Mev quanta; the coincidence circuit had a time resolution of $2 \cdot 10^{-7}$ sec. The γ-spectrum was analyzed with the help of a pulse-height analyzer. The angular distribution of the 4.4-Mev quanta emitted on the transition of the C^{12} nucleus from the first excited to the

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ground state ($2^+ \longrightarrow 0^+$) could be described by $f(\vartheta) = A + \sin^2 2(\vartheta - \vartheta_0)$ (cf. Ann. Phys., 2, 471, 1957) with $A = (0.27 \pm 0.14)$ and $\vartheta_0 = (80 \pm 13)$. The anisotropic part of the $f(\vartheta)$ function has the same character, independent whether the angle of emission of inelastically scattered neutrons is fixed or not.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute imeni P. N. Lebedev AS USSR)

L 16138-63 EWT(m)/BDS AFFTC/ASD

ACCESSION NR: AT3001852 S/2504/62/014/000/0117/0146

AUTHOR: Frank, I. M.

TITLE: A pulse method for the investigation of the properties of slow neutrons

SOURCE: AN SSSR. Fizicheskiy institut. Trudy, v. 14, 1962, 117-146

TOPIC TAGS: neutron, slow, pulse, flashing, spectroscopy, prism, fast, flight time, life time, diffusion coefficient, attenuation, moderation, moderated

ABSTRACT: This classical theoretical paper discusses the possible application of a high-voltage ion tube operating in a pulsed regime for the study of the properties of slow neutrons. The paper reproduces a report of the Fizicheskiy institut AN SSSR (Physics Institute, AN SSSR) dated March 1954. The material of this study, together with the results of an experimental investigation on the same subject, was utilized in the report of A. V. Antonov, A. I. Isakov, I. D. Murin, B. A. Neupokoyev, I. M. Frank, F. L. Shapiro, and I. V. Stranikh at the First Geneva Conference on the Peaceful Use of Atomic Energy. The paper is reprinted essentially without any alterations. The pulse method can be employed most naturally for the determination of the maximum magnitude of the diffusion coefficient D of neutrons and its dependence on the conditions of the experiment. Inasmuch as in many instances not only D but also the life time of the neutron, T, can be determined, $L^2 = DT$ can thus

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also be obtained. The method provides indications on the time required for the establishment of a stationary velocity spectrum of neutrons and on the behavior of various groups of slow neutrons. More complete information on the properties of a neutron gas can be obtained by the method of the "pulsed prism" which permits the determination of the moderation (deceleration) parameter τ. Section 1 provides a survey of existing neutron-moderator theory, especially in the light of the effect of a pulsed emission regime. Sec.2: The application of a pulse-type neutron source for the study of the diffusion of a neutron gas. Sec.3: The initial distribution of decelerating neutrons. Sec.4: The density attenuation of slow neutrons. Sec.5: A pulse-type neutron source in a prism. Sec.6: Application of two-group theory in the case of a pulse-type neutron source. Sec.7: Conclusions: (1) The principal application of a pulse-type neutron source at the present time appears to be in flight-time neutron spectrometry. The use of $T(d,n)^4He$ in the "flashing-tube" method opens broad perspectives in various areas of neutron physics. Possible applications: Assuming that fast neutrons from a pulse-type source enter a system comprising a test substance and having a prescribed shape, for example a cube, a parallelepipedon, or a sphere, and dimensions that differ not too greatly from the neutron moderation length, the exponential law of the density attenuation of the neutron gas, beginning at a certain time point, permits a direct determination of the diffusion coefficient D (assuming the life time T to be

0

approximately known). (2) In substances in which the velocity distribution of moderated neutrons becomes stationary within a time that is less than the lifetime of the slow neutrons, the magnitude of D will also attain a constant value. Inasmuch as in such substances D is independent of Ω, that is, the dimensions of the system, the magnitude of D becomes a physical constant that characterizes the neutron properties of the substances investigated. The magnitude of the attenuation coefficient, α, will then depend linearly on Ω; the slope of the α-vs.-Ω line obtained by means of measurements in systems of various sizes yields D, while its initial ordinate, obtained by extension of the line to $D = 0$, provides the magnitude of 1/T. This method requires considerably less test material than the customarily employed prism method. (3) In extremely small systems, that is, in systems having a large Ω, it may be anticipated that the magnitude of D_{eff}, as determined from the magnitude of α, will decrease with an increase in the dimensions of the system. This peculiarity can be employed for the clarification of the properties of the various groups of slow neutrons. (4) The exponential behavior of the density of the neutron gas in the system is not established at once; the investigation of the duration of the transition stage can provide indications relative to the duration of the establishment of a stationary velocity distribution of the decelerating neutrons. (5) The most complete indication on the moderation (deceleration) and the diffusion of neutrons can be obtained by the method of the "flashing"

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prism, that is, by placing a pulse-type source inside a prism. (6) In some instances, for example, for water, it may be useful to employ a system consisting of a plate of prescribed thickness and great area (approximating a two-dimensionally infinite system). "In the course of the performance of this study, and in the discussion of its results, many valuable observations were made by F. L. Shapiro, to whom I express my warmest gratitude. I also thank M. V. Kazarnovskiy and A. V. Antonov for a number of remarks made in the discussion of the work." Orig. art. contains 2 figs., 2 tables, and 96 numbered equations.

ASSOCIATION: Fizicheskiy institut AN SSSR (Physics Institute, AN SSSR)

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B102/B186

AUTHORS: Benetskiy, B. A., Frank, I. M.

TITLE: Investigation of the angular correlation between γ-photons and 14-Mev neutrons inelastically scattered from carbon nuclei

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 44, no. 2, 1963, 454-461

TEXT: The possibilities of n'γ angular correlations are discussed in order to obtain an unambiguous answer to the question as to whether the process $C^{12}(n,n'\gamma)C^{12}$ occurs via compound nucleus formation or via direct interaction. It is found that in the latter case a state of definite parity (2^+) will result and the distribution will be symmetrical with respect to $(\vartheta_n-\pi)/2$, i.e. the correlation will be characterized by $\sin^2 2(\theta_\gamma - \vartheta_n/2-n\pi/4)$. The n'γ correlation was measured in a simple arrangement: the neutrons were obtained from a DT source (E_n = 14.2 Mev);

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the γ-rays were detected by a NaI(Tl) crystal ($2 \cdot 10^{-7}$ sec) connected with an ФЭУ-29 (FEU-29) photomultiplier; the neutron detector ($4 \cdot 10^{-9}$ sec) was provided with an FEU-24. The coincidence between 4.43-Mev γ-quanta ($2^+ \rightarrow 0^+$ transition) and the neutrons scattered through a certain angle was recorded by scintillation counters. The target was a graphite cylinder 15 cm high and 6.5 cm thick. The γ-ray angular distributions were measured in the n-n' plane for the fixed n' emission angles 40 and 135°. They can be described by $f(\theta_\gamma) = 1 + b \sin^2(\theta_\gamma - \theta_0)$ where b and θ_0 were calculated by the method of least squares. The scattering cross-section ratio was $\sigma(40^\circ)/\sigma(135^\circ) = 1.8 \pm 0.4$. When the results obtained for neutrons are compared with the analogous ones for protons it can be seen that for small angles the scattering mechanism depends only slightly on the nature of the nucleon, but for large angles the results obtained for neutrons differ from those for protons. It cannot yet be decided if the direct scattering mechanism is always contributed by another mechanism nor to what extent this occurs. For large scattering angles this contribution will be very important. There are 6 figures and 1 table.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

GOL'DANSKIY,V.I.; KUZNETSOV,B.G.,prof.; MIGDAL,A.B.; FRANK,I.M.; CHERNOV, A.G.; FAYNBOY,I.B.,red.
[The constitution of matter; first talk] Stroenie veshchestva; beseda pervaia. [By] V.I.Gol'danskii i dr. Moskva, Izd-vo "Znanie," 1964. 38 p. (Novoe v zhizni, nauke, tekhnike. IX Seriia: Fizika, matematika, astronomiia, no.5) (MIRA 17:5)

1. Chleny-korrespondenty AN SSSR (for Gol'danskiy, Migdal, Frank).

FRANK, I. M.; BUNIN, B. N.; NIKOLAYEV, S. K.; SHABALIN, Ye. P.; SHAPIRO, F. L.

"The experience of the pulsed fast reactor operation and its characteristics at injection of neutrons from a microtron."

report submitted for 3rd Intl Conf, Peaceful Uses of Atomic Energy, Geneva, 31 Aug-9 Sep 64.

ACCESSION NR: AT4041826 S/2504/64/024/000/0203/0211

AUTHOR: Frank, I. M.

TITLE: Some characteristics of the elastic moderation of neutrons

SOURCE: AN SSSR. Fizicheskiy institut. Trudy*, v. 24, 1964. Issledovaniya po neytronnoy fizike (Research in neutron physics), 203-211

TOPIC TAGS: neutron moderation, neutron, neutron velocity loss, age diffusion theory, dispersion spectrum, age equation, elastic moderation, neutron spectrum

ABSTRACT: In the investigation of the moderation and diffusion of neutrons, it is important to solve the problem of the instantaneous neutron spectrum. The age-diffusion theory assumes that neutron energy loss in scattering on heavy nuclei is small and that the neutron energy is a continuous function of time. However, there are deviations in energy and velocity from the mean square values which one would expect, for example, if all neutrons had the same initial energy. These deviations in the instantaneous neutron spectrum are usually not considered because of the complexity of the non-stationary theory.

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However, on the basis of a simple and approximate approach, the square of the velocity deviation from the mean value can be calculated. Starting from the probability equation that a neutron of velocity V (energy E) after a collision will have a velocity in the interval from V' to V' +dV' (energy E' to E' + dE'), the average velocity so obtained is given by

$$\overline{v'} = \int_{v'_{min}}^{v'} v' W(v')\, dv' = \frac{M + \frac{1}{3M}}{M+1} v_0 \qquad (1)$$

The velocity loss as a function of time is given by

$$\frac{dv}{dt} = -\frac{1-\frac{1}{3M}}{M+1}\frac{v^2}{\lambda} = -\frac{1}{M'\lambda} v^2, \qquad (2)$$

where M' is the mass of the nucleus. The mean square of the neutron velocity after one collision is then given by

$$\overline{v'^2} = \int_{v'_{min}}^{v'} v'^2 W(v')\, dv' = \frac{M^2+1}{(M+1)^2} v^2. \qquad (3)$$

and the square of the mean square deviation in velocity Δv^2 is given by

$$[\Delta v_1^2]_{n=1} = \overline{(v' - \bar{v}')^2} = \overline{v'^2} - (\bar{v}')^2 = \frac{1 - \frac{1}{3M^2}}{3(M+1)^2} v^2. \quad (4)$$

The time-dependent changes in values of $\left(\frac{\Delta V^2}{V^2}\right)$ due to the fluctuation in the mean free path is given by

$$\frac{d}{dt}\left(\frac{\overline{\Delta v^2}}{v^2}\right)_{cv} = \frac{d}{dt}\frac{\Delta v_1^2}{v^2} + \frac{d}{dt}\frac{\Delta v_2^2}{v^2} = \frac{4}{3M^2}\frac{v}{\lambda}; \quad (5)$$

If the velocity loss were always equal to a mean value, the change in $\frac{\overline{\Delta v^2}}{v^2}$ would occur according to

$$\frac{d}{dt}\left(\frac{\overline{\Delta v^2}}{v^2}\right)_{cp} \approx -\frac{2v}{M\lambda}\frac{\overline{\Delta v^2}}{v^2}. \quad (6)$$

It is shown here that the instantaneous neutron spectrum converges toward the stationary distribution given by

$$\frac{\overline{\Delta v^2}}{v^2} = \frac{2}{3M^2}. \quad (7)$$

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The interval $\underline{X}^2$ of the change in velocity needed to establish a stationary value of $\overline{\frac{\Delta v^2}{v^2}}$ is calculated and expressed as

$$x^2 = \left(\frac{v}{v_0}\right)^2 \left(x_0^2 - \frac{2}{3M'}\right) + \frac{2}{3M'}. \quad (8)$$

If the moderator contains an impurity with lighter nuclei with effective mass $\frac{M'}{2}$, the time change in velocity is given by

$$\left(\overline{\frac{\Delta v^2}{v^2}}\right) \approx \frac{2}{3M'}\left(1 + \frac{M'\lambda}{M_1'\lambda_1}\right). \quad (9)$$

and that in the magnitude $\overline{\frac{\Delta v^2}{v^2}}$ is given by

$$\frac{dv}{dt} = -\left(\frac{1}{M'}\frac{v^2}{\lambda} + \frac{1}{M_1'}\frac{v^2}{\lambda_1}\right) = -\frac{v^2}{M'\lambda}\left(1 + \frac{M'\lambda}{M_1'\lambda_1}\right). \quad (10)$$

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Finally, the conditions for the validity of the age-diffusion equation are discussed. "The author is indebted to F. L. Shapiro and M. V. Kazarnovkiy for numerous valuable comments." Orig. art. has: 40 formulas.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva, AN SSSR (Physics Institute, AN SSSR)

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L 5259-66 EWT(l)/EWT(m)/EPF(c)/ETC/EPF(n)-2/EWG(m) LIP(c) WW
ACC NR: AP5014805 SOURCE CODE: UR/0030/65/000/005/0096/0098

AUTHOR: Frank, I. M. (Corresponding member AN SSSR)

ORG: none

TITLE: Scientific session on the application of nuclear methods to solid-state physics

SOURCE: AN SSSR. Vestnik, no. 5, 1965, 96-98

TOPIC TAGS: nuclear physics conference, solid state physics conference, solid state physics, nuclear physics, nonmilitary nuclear application

ABSTRACT: A meeting of nuclear scientists and scientists from other fields was organized by the Department of General and Applied Physics and the Department of Nuclear Physics (both of the Academy of Sciences USSR) and the State Committee on the Use of Atomic Energy USSR and held from 9-10 December 1964 in Moscow.

The program consisted of reports on problems common to the physics of solids and liquids and nuclear physics. Yu. M. Kagan reported on the Mössbauer effect as a means for detecting very slight differences in nuclear frequencies and studying the internal fields of atoms or internal motions of matter. F. L. Shapiro discussed various uses of slow neutron

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ACC NR: AP5014805

scattering and described nuclear reactors as important devices for the study of condensed media. Positron annihilation as a means for investigating the physical and chemical properties of substances was treated in a report by V. I. Gol'danskiy. B. N. Samoylov's report discussed the loss of parity in weak interactions as a means for studying fields within matter with polarized nuclei. I. M. Frank reported on the possibilities inherent in the interdependence of transition radiation and the optical properties of the substance.

The necessity for closer cooperation between nuclear physicists and solid-state specialists is called for and the emergence of a new discipline—nuclear solid-state physics—is foreseen. The session, which was limited to three meetings, did not cover such problems as nuclear paramagnetism and radiation physics. These topics will be studied in future sessions. [FSB: v. 1, no. 12]

SUB CODE: NP, SS / SUBM DATE: none

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FRANK, I.M.

Transient radiation and the optical properties of matter.
Usp. fiz. nauk 87 no.2:189-210 O '65. (MIRA 18:11)

S/276/63/000/002/006/052
A052/A126

AUTHORS: Frank, János, and Kincses, István

TITLE: A method of manufacturing steel and non-ferrous balls

PERIODICAL: Referativnyy zhurnal, Tekhnologiya mashinostroyeniya, no. 2, 1963, 39, abstract 2B152 P. (Hung. pat., cl. 49 1, no.148840, December 31, 1961)

TEXT: The antifriction bearing plant in Debretsen (HungPR) has patented a method of manufacturing balls. The essence of the method is that the wire is heated in the voltaic arc, in an acetylene flame, by the electric resistance method or induction, to the temperature over the melting point and sprayed by compressed air. Fused drops fall into a corresponding cooling medium (oil, kerosene, aqueous solution of some salt or emulsion) and owing to the surface tension solidify in the form of balls. The process makes it possible to produce hardened balls of various structures by a proper selection of the cooling medium. The described process can be realized by means of the spraying pistol.

V. Bachin

(Abstracter's note: Complete translation.)

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FRANK, Janos; DREDAN, Istvan

Who should be in charge of manufacturing grinding wheels? Musz elet 19 no.8:4 9 Ap '64.

FRANK, Jaroslav

The Roirant R7 machine.

p. 302 (Sklar A Keramik) Vol. 7, no. 10, Oct. 1957, Praha, Czechoslovakia

SO: MONTHLY INDEX OF EAST EUROPEAN ACCESSIONS (EEAI) LC, VOL. 7, NO. 1, JAN. 1958

FRANK, JAROSLAV

CZECHOSLOVAKIA/Chemical Technology - Chemical Products and Their Application - Ceramics, Glass, Binders, Concrete. H-13

Abs Jour : Ref Zhur - Khimiya, No 3, 1958, 8756

Author : Frank Jaroslav, Obraz Karel
Inst : -
Title : Container Glass for Canning Factories.

Orig Pub : Sklar a keramik, 1957, 7, No 4, 110-112

Abstract : In manufacturing modern container glass it is necessary to take into account the technological process of canning and the stresses to which are subjected the glass jars in the course thereof. The jars are subjected to the greatest stresses during the process of sterilization. The conditions of annealing of the glass must ensure the elimination of internal stresses above 95 m μ /cm. Problems are considered which relate to design of jar necks, types of covers and color of glass depending on the nature of the preserved products.

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FRANK, J.

Preparing the standardization of devices for closing bunkers. p. 81.

Vol. 3, no. 3, Mar. 1954 (Mechanisace)
INZENYRSKE STAVBY
Praha, Czechoslovakia

So: Eastern European Accession Vol. 5 No. 4 April 1956

FRANK, J.

Use of a claw-type loader in building. p. 127.

Vol. 3, no. 4, April 1954 (Mechanisace)
INZENYRSKE STAVBY
Praha, Czechoslovakia

So: Eastern European Accession Vol. 5 No. 4 April 1956